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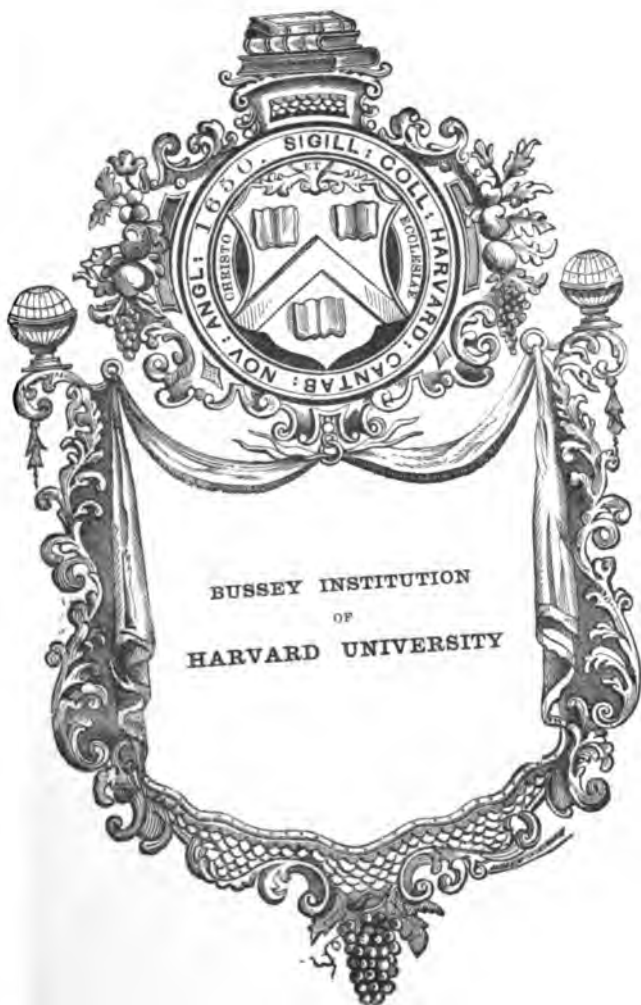
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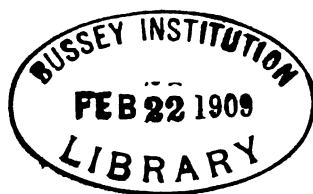


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is the most remarkable
cow the world has ever
produced.

*She testing officially
July 1st 1885 as a heifer
30 lbs. 15 ozs. butter in
7 days besides making
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BREEDER OF
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of my herd.

ETHLEEL 2ND 32291.
Official test 30 lbs. 15 oz. at 2 ½ years.
NASHVILLE, TENN

BIENNIAL REPORT
OF THE
COMMISSIONER
—OF—
Agriculture, Statistics and Mines
OF THE
STATE OF TENNESSEE.

A. J. McWHIRTER,
COMMISSIONER.

ACCOMPANIED BY REPORTS OF

DR. J. M. SAFFORD, STATE GEOLOGIST, ON THE AGRICULTURAL GEOLOGY OF
THE STATE; JO. C. GUILD, INSPECTOR OF MINES; PROF. E. W. DORAN,
ASSISTANT ENTOMOLOGIST; PROF. J. W. GLENN, DIRECTOR OF
EXPERIMENTAL STATION, AND C. W. CHARLTON, ASSISTANT
COMMISSIONER FOR EAST TENNESSEE; ALSO REPORTS
OF COUNTY AGRICULTURAL FAIRS; EAST TENNES-
SEE FARMERS' CONVENTIONS, 1885 AND 1886,
AND INTERSTATE AGRICULTURAL AND
IMMIGRATION CONVENTION, HELD AT
JACKSON, FEBRUARY, 1886.

NASHVILLE, TENN.:
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REPORT.

BUREAU OF AGRICULTURE, STATISTICS, AND MINES, }
NASHVILLE, January 1, 1887. }

To His Excellency, WM. B. BATE, Governor of Tennessee:

In compliance with an act of the Legislature (Acts 1875, chapter 13), I herewith submit my Biennial Report for the years 1885 and 1886; also the reports of James M. Safford, State Geologist, on the Agricultural Geology and Minerals of the State; Jo. C. Guild, Inspector of Mines, on The Condition and the Output of the Coal Mines of the State; Prof. E. W. Doran, Assistant Entomologist, on The History and Habits of Insects Injurious to Vegetation and the Best Methods for Preventing Same; Prof. J. W. Glenn, Director of Experimental Station, University of Tennessee, Knoxville, on Experiments and their Results in the Cultivation of Wheat, Corn, Cotton, Garden Products, Clover, and the Grasses, Barn-yard Manure, Commercial Fertilizers, Chemical Fertilizers, Ensilage, etc.; the report of C. W. Charlton, Assistant Commissioner for East Tennessee, on The Condition of Agriculture, Mining, and Manufacturing in that Grand Division of the State; the reports of County Agricultural Fairs, 1886; East Tennessee Farmers' Conventions, 1885-86, and the Interstate Agricultural and Immigration Convention, Jackson, Tenn., February, 1886—all of which I most respectfully submit, through your Excellency, for the careful consideration of the Honorable Members of the Forty-fifth General Assembly of Tennessee.

The condition of agriculture, and other information, as reported by the several county crop correspondents and statistical tables; the reports of county fairs, awards of premiums, etc.; the catalogues of thoroughbred and registered live stock (which is one of the most important factors in Tennessee agri-

culture); the output of the iron furnaces and coal mines; the catalogue of cotton and of the woolen mills; the industries of Memphis and other cities of Tennessee; the wonderful development of the smaller industrial establishments throughout the State, and the rapid increase of population and capital—all will be found of special value and importance in comparing and illustrating our industries and resources with years that have passed.

OUR PROGRESS.

A review of the past biennial term gives everywhere indications of progress and substantial development. Prosperity rules the hour. Tennessee has been peculiarly blessed with favorable seasons for planting, growing and securing crops. The forces of nature have been supplemented by intelligent industry; crops in every division of the State have been of large yield and excellent quality; with seasonable showers, drought, which parched the crops of other sections less favored than Tennessee, has been but slightly felt by us. Contagious diseases have not visited our borders. As a result of these blessings, the hearts alike of the rural home, the work-shop, the counting-house, and the opulent banker, have been filled with abundant gladness. Unexampled prosperity smiles upon the practical and industrious man, in whatever avocation he may be found, on the soil of Tennessee.

TENNESSEE'S DEVELOPMENT.

Tennessee is increasing rapidly in its material wealth. Much of this increase is attributed to the exhibit made by your Commissioner of specimens of the minerals, timber, and other natural resources, and of the agricultural products of the State, at the Mechanics' Institute Fair, in Boston, Mass., and the Southern Exposition, Louisville, Ky., in autumn of 1883. But far more is due the exhibits made at the World's Industrial and Cotton Centennial Exposition, New Orleans, La., in 1884-85,

and the Exposition of the Three Americas, also at New Orleans in 1885-86—the latter without the slightest cost to the State.

At these "Universities of Object Lessons" the farmers, mechanics, manufacturers and capitalists of the world were brought face to face with the natural resources and diversified products of our soil and of our industrial establishments. Scientists from Europe, South and Central America, Mexico, and from all the States of the Union, lingered about the space occupied by Tennessee at these Expositions, examined, *noted*, and *ofttimes* took away with them fragments or small specimens of iron, copper, zinc, and other ores, marble, and specimens of Tennessee corn, cotton, tobacco, wheat, oats, rye, barley, and grass seeds. (Several thousand paper packages of Tennessee *seed corn* were distributed to visitors from all parts of the world.) The impression thus made upon the minds of the farmer, mechanic, manufacturer, and capitalist, led to further inquiry, which eventuated in great gain to the State. Investments of foreign capital were made in hundreds of thousands of acres of the coal, iron, timber and farming lands of Tennessee. One Chicago firm purchased 100,000 acres of wild land contiguous to the Nashville, Chattanooga & St. Louis Railway, in the counties of Dickson, Humphreys, and Houston; another firm purchased 30,000 acres in Humphreys and Perry; several firms bought more than 100,000 acres in the counties of Unicoi, Sevier, Cocke, Johnson, and Carter; large bodies of timbered and mineral lands were purchased from citizens of Fentress, Cumberland, Scott, Morgan, Anderson, and Campbell. Hon. W. J. Whitthorne, of Columbia, Tenn., sold near 100,000 acres of iron ore lands in Lewis, Lawrence, and Wayne to three separate syndicates. Col. John H. Moore sold the valuable iron property known as the "Jerry Ore Bank," Hickman County, to parties in St. Louis, Chicago, and Buffalo. The Brownsport iron property, of Decatur County, and the Cedar Creek iron ore banks, have been sold to Memphis and New York parties. The Ætna Furnace iron property, Hickman County, has been purchased, and an 100-ton furnace erected and in blast. Two other furnaces will be erected at South Pittsburgh, and one completed at Dayton by March 1, 1887. Marble

has been discovered and the quarries are being opened up in Franklin County. The marble quarries of East Tennessee, which in 1880 did not ship more than fifty cars in the aggregate per annum, are now shipping to foreign markets more than 1,500 cars per annum. The lithograph stone quarries and lands have been sold to Louisville parties, and a stock company capitalized at \$1,000,000. Nor is this the end. Manufacturers from less favored sections of the North have, with an impetuous leap, bounded into Tennessee, and have erected extensive machine, nail, furniture, tile and pipe works, tanneries upon an immense scale, cotton-seed oil, cotton fabric, woolen, planing, sash, door and blind factories, and iron foundries, such as are to be found in Johnson City, Knoxville, Athens, Cleveland, Dayton, Chattanooga, Tullahoma, South Pittsburg, Nashville, Columbia, Clarksville, Jackson, Union City and Memphis. Tobacco manufactories have been established in Bristol, Greeneville, Nashville, Clarksville, Dresden and Union City. Extensive creameries have also been established in Bellbuckle, Murfreesboro, Lebanon, Nashville, Clarksville and Paris.

Another and an important evidence of the State's prosperity is witnessed in the remarkable advance which has occurred in her manufacturing stocks and railway shares, many of which but a few months ago were selling—notably East Tennessee, Virginia & Georgia common stock at $3\frac{1}{2}$; Tennessee Coal, Iron & Railroad stock at 43; Louisville & Nashville Railroad stock at 40; Nashville, Chattanooga & St. Louis stock at 44, and Sheffield Land Company at 46 cents. These stocks command at this writing, and in the order named above, $17\frac{1}{2}$, 113, 64, 99, and 250.

AGRICULTURAL PROGRESS.

The progress of Tennessee is further illustrated by comparison of the live stock, farm, orchard, garden, barn-yard, dairy, forest and manufacturing products of 1886 with those of 1879, upon which the census of 1880 was predicated. The following table gives the items of increase over the returns for same articles in 1880, viz:

Article.	Increase over 1880.
Wheat, bushels.....	5,668,647
Oats, bushels.....	170,184
Barley, bushels.....	89,981
Tobacco, pounds.....	6,634,948
Hay, tons.....	63,302
Clover seed, bushels.....	5,211
Grass seed, bushels.....	5,902
Poultry, barn-yard, head.....	617,733
Poultry, other, head.....	330,546
Eggs, dozens.....	3,652,518
Irish potatoes, bushels.....	545,519
Sweet potatoes, bushels.....	270,099
Horses, head.....	31,934
Mules and Asses, head.....	20,809
Work oxen, head.....	1,365
Milch cows, head.....	36,468
Other cattle, head.....	54,295
Swine, head.....	108,000
Pounds of butter made on farms.....	2,682,954
Garden products.....	\$ 88,731
Forest products.....	\$1,873,184

In consequence of the cut-worm, which injured the stand of early corn, and drought, which affected the late planting, Tennessee made only 58,000,000 bushels in '86, against 62,000,000 in '79. There is also a decrease in acreage planted to cotton, and also of the product of that staple, amounting to about 36,000 pounds.

There is an apparent decrease in the number of sheep, amounting to about 146,041 head, and a corresponding decrease of wool, amounting to 340,295 pounds. This should be charged to the worthless curs of the State.

MANUFACTORIES.

The products of the cotton, woolen, cotton-seed oil, lumber, flouring and grist mills, the ice factories and foundries of the State have increased more than 100 per cent. since 1880.

PIG IRON.

In 1879 Tennessee produced only 78,000 tons of pig iron, and in 1883 only 133,000 tons. Predicating our calculations upon the present weekly output, the product of all the furnaces of the State during 1886 aggregated about 300,000 tons, or near one-half as much as was produced in all the Southern States during 1879.

LIVE STOCK.

In no one branch of agricultural industry has Tennessee made such wonderful progress as in the breeding of the blood-horse—the trotter, pacer, Clyde and Norman horse—and in Shorthorn Jersey, Holstein, Devon, Sussex and Angus cattle, and in that hardy animal of all work, the mule. The County of Maury grazes and ships annually more mules than any county in the world.

Mark R. Cockrill, Esq., deceased, of this vicinity, was the pioneer, and during life the peer, as the breeder of the “Rose of Sharon,” *pure Bates Shorthorns* and *pure bred Merino sheep*. *He took all the first prizes on his Shorthorns and Merino wool wherever shown, whether in Vienna, Paris, Berlin, London, or the Centennial Exposition, Philadelphia.* To his sons, Benjamin F., Mark S. and James, he bequeathed the remnant of his blooded horses, Rose of Sharons and Marino sheep, and their catalogues will be found in this report; also that of the Belle Meade Stud of thoroughbred or blood-horses, owned by the venerable Gen. Wm. G. Harding, near this city. This is the largest breeding establishment of the blood-horse in America, if not in the world. The Ewell Farm Herd and Stud is also a grand factor in the industry of trotting horses and Jersey cattle. It was on this farm that the author examined the first Jersey cow he ever saw in Tennessee. But Mr. Newton T. Beal, of Rogersville, claims proprietorship of the pioneer in this important family of cattle. See his catalogue. To Thomas M. Spofford (Martin-hurst), Buford Post-office, Giles County, Tenn., belongs the honor of having made the first importations of the all-purpose Holstein-Friesian cattle and Clyde horses into the Southern

States; as also to Mr. E. D. Hicks, of Nashville, for his importation of the Devon; and Mr. Overton Lea, of (Lealand) Nashville, for his importation of the Sussex. All will prove a source of great wealth to Tennessee live stock breeders. The Hermitage Stud of roadsters, headed by the great Wedgewood, will also make its impression on the trotting stock of Tennessee. Full catalogues of all to be found in this report.

Space will not admit of my naming all engaged in this most pleasant and profitable industry. But I cannot part with this subject without *emphasizing* the fact that Tennessee has produced on its own soil more Jersey cattle of large butter record than any other State in the Union. Many of them, in fact, are world beaters. I refer especially to Lanseer's Fancy, Ethleel Second, and many others to be found in the catalogues of their owners, which are embodied in this report.

ASSESSMENT OF LANDS.

Notwithstanding this grand display of progress and development and the world of wealth flowing therefrom, the puerile plea has been made "that, notwithstanding the Commissioner of Agriculture, etc., has done more advertising of Tennessee lands, and at heavier expense than ever before, farm lands of the State have declined some million or more of dollars, whilst city property has advanced."

Why this decline? Viz: Because the lands, especially non-productive lands of the State, are *assessed at a minimum*. For example, the coaling lands of Wayne County and wild lands, as they are termed, in Houston, Dickson, Stewart, Humphreys, Hickman, Lawrence, Coffee, DeKalb, White, Warren, Cumberland, and in all upland or mountainous counties, hundreds of thousands of acres of these lands are assessed at the low valuation of 10 to 25 cents per acre. Just such lands have been sold during this biennial term at from \$1 to \$3 per acre, which were *taxed by the State and for the State at ten cents per acre*. Farming lands also, under our present system of assessment, which would readily fetch from \$15, \$20 and \$25 per acre, are assessed as low as \$8, \$12 and \$15. Many cases are

in my mind's eye of under-assessments. Some of them, in fact, are not assessed at one-fourth their market value.

It is believed by a majority of our most astute statisticians that if all of the real, personal and mixed property of the State was assessed, at a fair cash valuation, that it would swell the tax lists to \$750,000,000, instead of the meager sum of \$262,000,000, and that taxes, in like ratio, would be reduced. There are but few, if any, States in the Union that can show a smaller State tax and county tax assessment than Tennessee.

IMMIGRATION.

The emigration which for many years moved as a tidal wave from Tennessee Westward, has ceased. It has been met by a counter current of immigration composed of practical, industrious, solid men—English speaking people from the North and the Northwest States that are coming in a constant stream to Tennessee. More than 8,000 families have been added to the population of Tennessee since January, 1883, and they have been distributed generally, not in large colonies, throughout the State. More than 500 have located in Rhea County; more than 1,000 in Hamilton. Many of these families are farmers, and have purchased and paid for lands they occupy. Lands on Missionary Ridge which a few years ago could have been purchased at five to seven dollars per acre, cannot now be bought at \$200 per acre. These facts can be attested by many of the most respectable gentlemen in Chattanooga. Hundreds of families have located in Bradley, Roane, Marion, Cumberland, Coffee, Warren, Hickman, Lawrence, Dickson and Robertson Counties, and are doing well upon lands hitherto totally disregarded by the older citizens for agricultural purposes. New and comfortable, often splendid, residences, spacious barns, well-fenced farms and orchards of luscious fruit have taken the place of the log cabin and the rail-pen stable of the former owner. The adornments of the home and the farm are conspicuous. Improved machinery and better methods are introduced. Diversified agriculture, fruit, small and large, a larger area devoted to the grasses, more and improved breeds of live

stock ; the Clyde, the Norman and the Hambletonian takes the place of the ox ; the Shorthorn, Holstein, Jersey and Devon succeeds the scrub cow ; and the Poland China and Berkshire retires the *razor-back* hog. These all point to competence if not to opulence.

It is with peculiar pleasure that Tennesseans point the immigrant, come from what land or State he may, to their school houses, academies, colleges and universities ; and with no less pleasure do they refer to their churches which adorn every civil district in the State. These, with the newspapers which are published in every county in the State, are the best evidences of that high civilization which have given her citizens reputation at home and fame abroad. The avenues to knowledge and religious worship, which develop the nobler qualities of the mind, are many and broad in Tennessee.

Tennessee also offers the immigrant a climate unsurpassed by any State in the Union for salubrity ; water pure and health-giving ; soil fertile, versatile and inexhaustable ; a mean temperature and rainfall that will compare favorably with the best of other States ; lands cheaper than can be found in any of the Western or Northwestern States ; and a people as hospitable as they are chivalrous, who will extend the right hand of fellowship to all honest, industrious men coming from less favored sections of this or foreign countries with a view of making their homes in Tennessee. We have room and to spare for all such who may come to Tennessee.

MANUFACTURING CITIES,

and those centers around which the greatest industrial development of Tennessee will crystallize in the near future, are: Memphis, Jackson and Union City, in West Tennessee; Clarksville, Nashville, Columbia and Tullahoma, Middle Tennessee; and South Pittsburg, Chattanooga, Knoxville and Johnson City, East Tennessee.

The most important factors connected with such enterprises and their steady and material growth, are cheap fuel, structural

and other raw material for building and manufacturing, cheap transportation, and an abundant supply of good water at slight expense, cheap and wholesome food, and men of capital and enterprise to lead the way.

MEMPHIS.

When the railroad now being built to Birmingham, and one other road as a competing line through a similar section filled with coal and iron ore, Memphis will possess more of these *sine qua non* conditions than are at present to be found elsewhere in Tennessee. Her only deficiencies, viz, good water and cheap structural material, are but a bagatelle. These can be remedied by a very small investment of capital—the building of filterers and one new railroad. Memphis is the peer of all the inland cities of the world in the movement of cotton, a full and comparative report of which, with other industrial developments within the past two years, will be found in this work. With the two railroads referred to above, and those now being constructed, Memphis will necessarily and of right enjoy better and cheaper transportation facilities than any city in the State. With the enterprise hitherto manifested by her citizens, we would not be surprised to see her in the very near future as great in wealth and as extensive and much more diversified in manufacturing than Manchester, England.

JACKSON.

Jackson, Tennessee, is favorably located for diversified industrial pursuits. Populated with an intelligent, enterprising people, surrounded by a fertile and fruitful section, supplied with the purest water to be found and a genial climate, with raw material of every kind at her threshold, nothing but a deficiency of cheap transportation can possibly retard her rapid growth and prevent her from becoming one of the great manufacturing cities of Tennessee.

UNION CITY.

The adverse circumstances of limited water supply (which in time will be remedied, does not prevent the manufacture of

furniture, barrels and staves, tile pipe and foundry products, and many other articles of practical utility at Union City, and at comparatively small cost. Her citizens are intelligent and enterprising, and the surrounding country is unexcelled in fertility of soil and magnificent timber, and her trade in furniture, lumber and staves is immense.

CLARKSVILLE.

Clarksville is situated on a stream which affords uninterrupted navigation thence to the outer world the year around. Situated on the north bank of Cumberland River, the finest wheat and tobacco lands known extend from the city limits north and east for many miles. South of the river iron ore banks, filled with brown hematite, pot and pipe ore, which assays from 52 to 57 per cent, lie within very few miles of the city, and the country around is filled with limestone and timber of best quality. It all lies there within easy reach, yet untouched for want of enterprise. Clarksville possesses a population unexcelled by any city in the State for capital, morals and intelligence. But she needs competing lines of railway into the coal fields of Kentucky, and also through the iron ore belt south and west. More than all, she needs men of capital and enterprise to develop the natural resources lying at her door, and Clarksville will become one of the largest manufacturing cities in the State.

NASHVILLE.

Nashville is to the Southern States, with two vital exceptions, what Boston claims to be to the New England States and also to the United States of America, viz: the seat of morals, capital, enterprise, and learning. Nashville is the peer of all Southern cities in morals, educational facilities and capital. But Nashville needs four additional railroads, viz: one leading direct through the western iron ore belt, and Jackson, Tenn., to Memphis; one leading through Wilson, Smith, Putnam and Cumberland Counties to Knoxville, and eastward to the Atlantic; another running northwest through the coal fields of Kentucky;

and still another running southeast, through Marshall and Lincoln Counties, to Huntsville, Ala. All should be under separate and distinct management.

Nashville cannot and will not reach the position to which she aspires—the *metropolis of the South*—unless it be through the doors of her great manufacturing establishments. Her commerce in merchandise now extends as far as her energetic merchants can drive it; but the country beyond has been reached by her enterprising manufacturers only. To such firms as the Phillips & Buttorff Manufacturing Company, the Tennessee Manufacturing Company, the National Manufacturing Company, the Nashville Manufacturing Company, the Tennessee Plow Factory, the Tennessee Wagon Factory, Valentino & Co., Johnson Car-seal Company, G. W. Cunningham & Co., and a few others not at present remembered, should be accorded all honor for the example published by them to the world that, even under adverse circumstances, Nashville does manufacture some goods that compare favorably in quality and prices with those of similar character from other sections of the Union.

With cheaper fuel for manufacturing purposes, and competitive lines of railway to the ore banks of the State, and to the Gulf and seaboard beyond, and with a population of men—*practical men of enterprise*—Nashville would double her population by the year 1900. Nashville needs more railroads and a larger number of enterprising men.

COLUMBIA.

Columbia, the county-seat of Maury—the largest *mule* county in the world, and one possessing as many natural advantages—is situated midway between the Warrior (Ala.) coal fields and those of Southwestern Kentucky, and about the same distance from the splendid coking coal of Sewanee. It is also within less than forty miles of the richest iron ore beds of brown hematite known in Tennessee. The culture, morals and enterprise of her citizens are unexcelled by those of any other city of its size in the South. But she is deficient in the matter of cheap transportation. Two or three more lines of railroad,

under separate and distinct managements, would insure a rapid and wholesome growth in population and wealth to this beautiful and healthy city. Columbia and Clarksville are the only towns in the Central Basin of Tennessee that have invariably escaped cholera when it prevailed in the form of an epidemic elsewhere. Columbia will become a great manufacturing city in the near future.

TULLAHOMA,

situated on the line of the Nashville, Chattanooga & St. Louis Railway, sixty-nine miles east of Nashville, is destined to become a manufacturing city of much importance. Railroad facilities extending directly south to Decatur, Ala., and Columbus, Miss., and immediately north to Cincinnati, Ohio, would insure her a population of 50,000 souls within the next twenty years. There is not a healthier town in all of Tennessee than Tullahoma, and her citizens are intelligent, moral and enterprising. She is literally surrounded with excellent structural material, and within easy reach of magnificent forests of hard wood. The creek of pure and soft freestone water which runs through her corporate limits, offers very great inducements to those who desire to establish bleacheries, or cotton and woolen mills, or any of the smaller industries which require steam power. There is but one difficulty that stands in the way, viz, cheap railroad transportation to all points of the compass. This removed, Tullahoma would spring into opulent life as a manufacturing city, deriving her revenue and her population from the many and varied industries, such as manufactories of combs, brushes, edge tools, cutlery, screws, light castings, sewing machines, toys, organs, melodeons; the finer textile fabrics of wool and of cotton, and many articles made of wood. Tullahoma has a bright future.

SOUTH PITTSBURG.

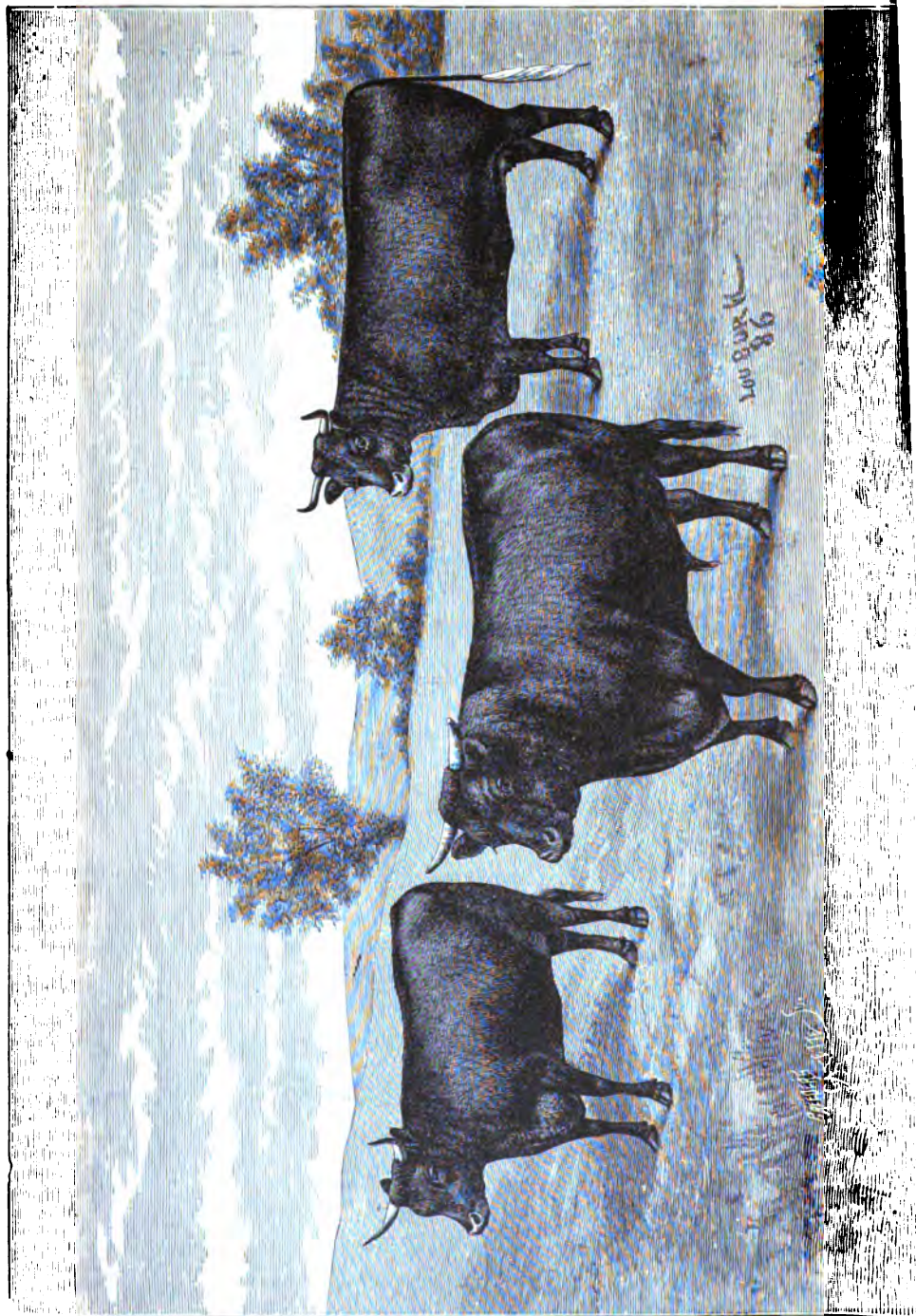
Mr. James Bowron, the practical and astute agent of the Southern States Coal and Land Company (limited), builded wisely and well when he founded the city of "South Pittsburg," located on the north bank of the Tennessee River, and nearly

midway between Bridgeport, Ala., and Jasper, Marion County, Tenn. The location of South Pittsburg for a great manufacturing city is excellent. Situated as it is, within ten or fifteen miles of inexhaustible coal fields bearing a coking coal not inferior to that of the celebrated Tennessee Coal, Iron and Railroad Company, and within less than two miles of the celebrated Battle Creek mines, which afford the best grate coal discovered in the State; and within fifteen or twenty miles of one of the best red hematite or fossiliferous ore banks known in that section, which is prolific in iron ore. The conditions, with the single exception of ample facilities for rapid transit of the products of the mills, furnaces, shops and foundries that will, in the near future, be established here, are all that could be desired, and, however, that objection may be overcome by the building of a double track to East Bridgeport, on the main trunk line of the Nashville, Chattanooga & St. Louis, and to the nearest point on trunk line of the Memphis & Charleston, whenever that railroad is completed through from Stevenson, Ala., via Jasper, Tenn., to Chattanooga. South Pittsburg has a bright future in the manufacture of pig, castings of all kinds and heavy machinery, and she may derive a large revenue from the manufacture of furniture and other articles of wood.

CHATTANOOGA.

For the manufacture of all articles composed of iron, wood, cotton and wool, no city in the South is more favorably located than Chattanooga. Located on the south bank of the Tennessee river, with seven first-class railroads entering and departing from the center of the city, an ample supply of pure and excellent water for all purposes, and surrounded with magnificent forests of hard wood, the mountains and hills within twenty miles, filled with coal and iron and limestone, the valleys of the Tennessee, Chickamauga and Lookout affording fertile agricultural lands. An intelligent, practical, enterprising and industrious people, with these conditions environing this young giant of industry, who can foretell its true destiny?

With two or three millions of additional banking capital, and the introduction of many industrial establishments for



which the city is admirably adapted, such as edge tools, steel rails, engines of all kinds, cutlery of all kinds, agricultural implements, cotton gins, cotton factories for the finer fabrics, woolen mills, hat and shoe factories, saddlery and harness factories, shelf hardware, etc., introduce these and her population will reach 100,000 before 1900.

KNOXVILLE.

Solid from turret to foundation stone, Knoxville rests upon her hills of variegated marble and counts the ducats that are pouring into her vaults from the channels of her mercantile commerce, which extend far into Western North Carolina, Northern Georgia and Alabama, Southeastern Kentucky, and the counties of East Tennessee.

Chattanooga is not more favorably located, nor is she surrounded with conditions more conducive to a large manufacturing business than Knoxville. She certainly has not the capital that Knoxville commands, yet her manufacturing establishments largely excel those of Knoxville in number and in product.

A higher order of civilization; a more hospitable and successful people than the citizens of Knoxville are not to be found anywhere. But they are sadly in need of men of enterprise, and railroad facilities.

With four other roads running into Knoxville, accompanied by a few men of enterprise, the city would expand, and more than one hundred thousand souls would find lodgment within its borders.

Variegated marble of the greatest variety, and susceptible of the highest polish, is to be found in the hills surrounding the city. Inexhaustible coal fields lie within forty miles north, and brown hematite ore banks within twenty miles west, and limestone within full view all around the city. But there is not one furnace nearer than Chattanooga that manufactures pig iron for the trade, where there should be more than one dozen furnaces. The erection of furnaces would induce the erection of rolling mills, extensive machine shops, etc.

Car wheels of superior quality are manufactured here, from the Stony Creek iron ore of Carter County; also bar iron, etc. There is also a first-class woolen mill and cotton factory. Marble is one of the large and profitable industries. Pearl buttons, saddles and harness, and furniture are manufactured in Knoxville and prove very remunerative. In many of these articles her trade extends throughout the United States. But there should be twenty establishments, small and great, to every one now employed. Give Knoxville a few more railroads and a few more enterprising men, and the rapidity of her growth would surprise her most sanguine friends.

It must not be supposed that the city of Knoxville is indifferent to manufacturing enterprises. To be sure, it has given more attention to commercial pursuits than to manufacturing, being eminently a commercial city. At the same time it is not indifferent to manufacturing, there being a number of such enterprises already established and prosperous. They have grown steadily, are constantly increasing and foreshadowing an encouraging future.

It ought to become a manufacturing point on a large scale, owing to its proximity to the raw material. There is hardly any city in the Union more advantageously situated in this respect, when it is remembered that it is within forty miles of the most extensive coal and iron belts of the country, a fact capital is beginning to find out, and consequently is gravitating in this direction. Already more than half a million of dollars are invested in the various manufacturing industries of the city, including rolling mills, nail factories, numerous foundries, machine shops, woolen and cotton mills, car works, car-wheel works, etc.

We begin with the Knoxville Foundry and Machine Company, for the manufacture of mill gearing and machine circular-saw mills, steam engines, boilers, marble-working machinery and castings generally. Its officers consist of Peter Staub, President; J. B. Kelly, Secretary and General Manager, and C. M. Feuche, Treasurer. It employs seventy-five to one hundred hands; output, from \$150,000 to \$200,000 per annum; capital

stock, \$100,000 paid in, \$12,000 surplus. Its operations spread over portions of Kentucky, Tennessee, Mississippi, Alabama, Georgia, North Carolina, Virginia, South Carolina, and Arkansas. It is managed with singular skill and ability, and is one of the most important industries of the city.

The Southern Car Works, established in this city but a few years since, is one of the live, progressive manufacturing industries in our midst. It manufactures freight and mining cars, employs one hundred hands, and turns out \$30,000 of work per month, or \$360,000 per annum. This is rather less than one-half the capacity of the plant. The management calculates upon touching this output during the next few months. The capital originally invested was \$80,000. Mr. R. Z. Roberts is Secretary and Treasurer.

The Knoxville Woolen Mills were organized in 1877, with a paid-in capital of \$200,000. They manufacture pure woolen doeskin, which stands high in the market. The plant consists of seven sets of cards, 168 looms and employs 200 hands. Output per annum, \$350,000. The buildings are large, massive, and admirably adapted to the business.

The Knoxville Iron Company is one of the largest and most prosperous manufacturing institutions of the city of Knoxville. It is planted on a firm financial basis, and secure against financial disasters. Its President, W. R. Tuttle, has managed its affairs with singular ability and success. It employs 400 hands. The output of coal is about 100,000 tons per annum, and of iron about 6,000 tons.

MARYVILLE.

There are two woolen mills in Maryville, one owned by W. T. Parham, the other by Hannah & Thorn. The output of the Parham Mills is 2,500 pounds per week—572 spindles and 30 looms. They run day and night.

The output of the Hannah & Thorn Mills is 1,000 pounds per week—288 spindles and 10 looms. They run day and night.

JOHNSON CITY.

The real Birmingham of the United States, *in embryo*, is Johnson City, situated in Washington County, at the junction of the Cranberry Narrow Gauge with the East Tennessee, Virginia & Georgia Railroad, or will be within thirty miles of this point. This prediction is made with the entry of two exceptions: First, that an abundant supply of water for all purposes can be obtained at reasonable cost, and, second, that cheap railroad transportation can be obtained to and from the coal mines of Southeastern Kentucky and Southwestern Virginia, and also to the numerous iron ore and zinc ore banks, granite and limestone quarries which lie in close proximity to this city. Other conditions, such as climate, soil, timber, etc., are most favorable.

Since our first acquaintance with this section, we decided in our own mind that Bristol, Cumberland Gap and Johnson City would each attain an eminent position in the manufacturing world, and that the one which first succeeded in obtaining fair transportation facilities to the coal fields and ore banks, and also with the outside world, would obtain the prize of becoming *the Birmingham of America*.

Johnson City has a large tannery and also a large machine shop, and other industrial establishments which give great promise, all of which are owned and operated by very enterprising men. Should furnaces and the Bessemer steel plant promised be located here, it will give an impetus that will carry her into the twenty thousands at an early day.

MARBLE.

The marble interest within the last few years has assumed extraordinary proportions in East Tennessee. Twenty odd years ago no one supposed it would become a leading industry, or that it would attract attention and become a source of vast revenue. The immense quantities of the material spreading out over a broad surface of the country was looked upon as

useless if not a nuisance. The land occupied by it, in the estimation of the owner, was regarded as valueless and as so much waste land, and no one cared to own it.

How remarkable the change! What a marvelous revolution in the public mind touching its commercial value! Its development and utilization has grown into a gigantic business, involving large investments, the employment of hundreds of hands and the disbursement of fabulous sums of money. It would be no exaggeration to say that more than half a million of dollars is actively employed in Hawkins, Jefferson, Knox, McMinn, Union, Monroe, Bradley and Blount Counties in opening quarries and putting the material in shape for market. To-day it is finding its way into the cities of the North and East, and into the furniture establishments of those sections, where it is sawed, polished and utilized.

Hawkins County was the first county to lead off in the development of the material. For years it preceded all other counties in this direction and encountered difficulties sufficient to paralyze the most hopeful efforts. It was far removed from the lines of transportation, and the slow process of moving it may be imagined when oxen, six to ten in a team, pulled it to its destination.

Mr. Orville Rice was the pioneer in this work. His penetrating judgment led him to believe that the marble of Hawkins County could not be surpassed in the fineness of its texture, its susceptibility of a splendid polish and its beautiful, variegated colors. At that time (1840) there was not a railroad in East Tennessee, nor one through Southwestern Virginia to Lynchburg. He performed the extraordinary feat of hauling a load of it to Lynchburg, and from thence by rail to New York, where he had it on exhibition. He was succeeded by Hasson, Stamps, Evans & Co., Dougherty and others, who, possessing better advantages, have been successful, and whose output amounts to scores of tons annually.

For a long time it was known that the marble of Knox County was not only in the largest abundance, but of a fine quality, though hardly equal to that of Hawkins County. The development is of recent origin. For the want of experience

and the necessary machinery the first operators were not successful. They were followed by such enterprising men as Col. John J. Craig and Messrs. Harvey, Ross, Frierson, Beach, Evans, Nicolas, the Brewers, Harvey & Co. and others. They have pushed the business energetically and successfully. It is now on a firm basis and in no danger of a collapse. They secured valuable quarries on the banks of the Tennessee River, at Concord, on the East Tennessee, Virginia & Georgia Railroad, and a number of other localities hard by. Col. J. J. Craig is a veteran in the business, and perhaps is more familiar with the marble interest of East Tennessee than any man in our midst. He has given it his closest attention for years, himself a practical and successful operator and running one of the most extensive quarries we have. The combined output of all the quarries will reach fifteen hundred car-loads, or about three thousand tons per annum, and shipped to Cincinnati, Chicago, New York, Philadelphia, Baltimore and other markets.

There are several factories engaged in sawing the material into slabs, such as Jno. P. Beach, Beach & Pitman and Evans Marble Works, of Knoxville; Daily, Smith & Hill, Chattanooga, and Tripp & Parker, of Concord. Doubtless others will follow in due time.

Mr. George W. Ross, of the city of Knoxville, a wealthy and enterprising gentleman, was the first to develop building marble in Knox County, a beautiful, delicate, gray marble, very solid, compact and enduring. The Knoxville Custom House was built out of it, as also the Memphis Custom House and the Lee monument, New Orleans. His quarry is located near the city, and is perhaps one of the finest quarries of the sort in East Tennessee, if not on the continent.

Recent discoveries of marble of fine texture and beautiful, variegated color, have been made on the Daisy coal property of Messrs. Tabler, Crudup & Co., near Chattanooga, and also at Awalt, in the neighborhood of Tullahoma, Tenn. A strata of splendid building marble has also been developed in Franklin and Lincoln Counties, but it does not equal that of Hawkins, Knox and Blount in fineness of texture or beauty of color.

GRANITE.

Tennessee is rich in structural material of all kinds, and the day is not far distant when it will become a source of immense revenue. Granite of excellent quality is found in the counties of Carter, Cocke and Polk.

LIMESTONE.

An excellent quality of limestone is to be found in all of the counties of East and Middle, and in the counties of Henry, Benton, Carroll, Decatur, Henderson, Hardin and McNairy, West Tennessee.

IRON ORES.

Tennessee is greatly favored in iron ores, and often coal, iron ore and limestone are found within gunshot of each other. This is notably the case in the counties of Monroe, Bledsoe, Sequatchie, Hamilton, Roane, Anderson and Campbell. The black magnetic, brown hematite and red hematite, or fossiliferous, obtain at intervals throughout East Tennessee. West of Nashville, in the counties of Stewart, Montgomery, Houston, Dickson, Humphreys, Perry, Hickman, Lewis, Wayne, Lawrence, Hardin and Decatur, a hydrate ore, with yellow powder, extends over an area some fifty miles wide, from the Kentucky to the Alabama line, which is rich in heavy deposits, many of them untouched. This was the most extensive field for the making of charcoal iron in *ante-bellum* days. As many as eleven furnaces in those days were in full blast in the single county of Montgomery, and their proprietors became exceedingly rich from the manufacture of pig; but to-day there are but four running in this mineral belt, where there should be twenty, each of 100 tons capacity—the Warner, Warner Post-office, Hickman County, Tenn., with an output of 45 tons charcoal iron; the Cumberland Furnace, Dickson County, an output of 17 tons; the LaGrange, at Stribling, Stewart County, with an output of 45 tons, and the *Ætna*, which was erected in 1886, furnished with the latest and most approved machinery,

with an output of about 45 tons (the proprietors hope to extend it to 100 tons) daily. The Bear Spring and Dover furnaces are out of blast, and this—one of the most valuable pieces of iron property in Tennessee—belonging to the Cumberland Iron Works Company, containing about 84,000 acres of valuable timber, farming and iron ore lands, is now idle.

The Cowan Furnace, Cowan, Tenn., and the South Pittsburg (two stacks) are in operation and turning out about 80 tons each daily. The Chattanooga Iron Company's furnace, Chattanooga, is making 420 tons pig per week. The Roane Iron Company, Rockwood, Tenn., is turning out 100 tons daily, and the Dayton Coal and Iron Company (limited), one furnace in blast, with an output daily of about 110 tons. Another furnace belonging to this enterprising company will be completed and go in blast by March 1, 1887, with an anticipated output of not less than 100 tons daily. The Citico Furnace, Chattanooga, has made no report, but makes an output of about 560 tons weekly.

We regret to report the Oakdale, Jenks Post-office, and the Napier, Chief Post-office, are still out of blast, with no promise of resumption.

The South Pittsburg City and Land Company propose building two additional furnaces on their property during the current year. Two coke furnaces of 100 tons will be erected at Chattanooga during 1887. One charcoal furnace may be erected in Lawrence and one in Wayne the present year. The establishing of these charcoal plants, however, depend upon the construction of a railroad which has been promised by some of the enterprising capitalists of this and other States.

MANUFACTURE OF PIG IRON.

In 1882 Tennessee produced 137,602 tons pig, and in 1886 very near or quite 300,000 tons—only a few thousand tons less than Alabama. Wise legislation and competitive lines of transportation into and across the iron belts of Tennessee would go far toward determining this as the iron center of the United

States. Millions of dollars of capital from other States of the Union, and from foreign countries would flow into Tennessee for investment in the manufacture of steel rails, engines, locomotives, boilers, pipes, machinery of all kinds, edge tools, pocket and table cutlery, tin-plate, wire, shelf hardware, nails, spikes and other articles requiring iron in their manufacture, if Tennessee capitalists could only be aroused to the performance of their duty. There is no State that offers superior inducements for the manufacture of iron, and all articles made of iron, from a No. 12 needle to the ponderous trip-hammer or the forty-ton cannon. It is a well authenticated fact that a steam boiler made of the iron which is mined upon the property of the Cumberland Iron Works Company, Stewart County, Tenn., was never known to explode, and very similar ore is to be found in Montgomery, Dickson and Hickman Counties.

L. S. Goodrich, who but recently died at Warner, Tenn., was among the best friends of the western iron belt. At the time of his death he was a member of the Warner Iron Company, and did much by his knowledge of the iron property of Hickman County in influencing the building of the Nashville & Tuscaloosa Railroad, as well as the establishment of the present iron plants in that county. He was a nephew of the Hillmans, who were the pioneer iron men of Tennessee. So familiar was he with the mineral advantages of this State, as well as of Alabama, that long before the town of Birmingham had been built he purchased largely of iron lands adjacent to that city, which, if he could have made the last payment of a few hundred dollars, would have left an immensely valuable estate to his family. To Mr. Goodrich and to Mr. James C. Warner, of Nashville, Tenn., Tennessee is very much indebted for the present development of what is known as the Western Iron Belt of Tennessee.

ZINC.

Splendid specimens of zinc ore are to be found in Sullivan, Washington, Jefferson, Union, Knox and Claiborne Counties. The ore banks of Jefferson, Union, Knox and Claiborne are be-

ing worked, and the ore is being converted into spelter at Clinton, Tenn. A smelting works at Johnson City or Bristol would doubtless prove remunerative.

OCHRE

of rich quality is to be found in Lauderdale County, within one and a half miles of the Ripley Depot, Chesapeake, Ohio & Southwestern Railroad. Capitalists would do well to investigate this deposit.

KAOLIN

in large quantities is found in Campbell, Carroll and Fayette Counties, and is pronounced an excellent quality.

TIMBER.

Tennessee is the center of the hard-wood timber belt east of the Rockies, and is not surpassed by any State of the Union for forests. Several hundred thousand acres of excellent timber land have been sold to foreign and Northern capitalists within the past two years, which is now being rapidly denuded of its forests; and unless tree planting be adopted by the citizens of Tennessee, as has already been done by our enterprising and far-seeing neighbors of the Northern States, they will, in a very few years, find themselves importers instead of exporters of timber for building purposes. More than 800,000,000 feet b. m. are annually being consumed for railroad ties and building purposes, and for lumber which is exported. *Tennessee should by all means establish an ARBOR DAY.*

TRANSPORTATION.

Facilities for minimum or cheap transportation are greatly needed in many sections of the State, perhaps in none more than the counties including the western iron belt, the counties of the Upper Cumberland, the counties embraced in the coal field region of the Cumberland Plateau, and the counties

throughout the dyestone or red fossiliferous ore and brown hematite iron ore region of East Tennessee. The field here offered to capitalists for remunerative investments in railway bonds and shares is, and should be, inviting. Such opportunities are rarely offered to transportation lines by a comparatively small section that can supply raw material sufficient to run one hundred furnaces of 100 tons daily product. Build these roads and Tennessee would stand the peer of Pennsylvania in the manufacture of iron and iron goods.

SMALL FRUITS.

An important factor in the agricultural economy of the State is that of small fruits, and those who are engaged in this pleasant and profitable specialty are making money.

One of the leading societies in this department of agriculture is the West Tennessee Horticultural Association, with headquarters at Humboldt, Gibson County, an interesting report of whose last meeting will be found under the head of "County Fairs," and will be well worth the attention of all farmers. There is another association of Hamilton County and other East Tennessee farmers, but unfortunately we have received no report from it.

There are now about 3,000 acres planted to strawberries, blackberries, raspberries and grapes in the counties of Crockett, Haywood, Shelby, Gibson, Madison, Giles, Davidson, Grundy, Morgan and Hamilton. Lands in Gibson, Madison and Crockett Counties that a few years ago sold at \$5 per acre, cannot be purchased now at \$30, and those on Missionary Ridge, near Chattanooga, that sold at from \$7 to \$10, cannot be bought for \$200.

This marvelous advance is the result of the ascertained peculiar adaptability of these lands to growth of berries and other fruits.

Many parties engaged in the business have informed us that they frequently net more than \$100 per acre on strawberries.

STOCK AND CROP REPORTS.

Accurate statistical facts are impossible to be obtained with the amount of funds placed at our command, but your Commissioner has endeavored, with the aid of about eight hundred *volunteer* crop reporters, at the commencement of the planting season, viz, April of each year, which is reduced to about four hundred by November, the close of the reporting season, to obtain statistical facts of the comparative acreage of all commercial products of the farm, their condition from month to month until harvested, and amount of yield per acre. Also comparative conditions with the preceding year of all live stock, and their increase. These reporters do their work without fee or reward, except such seed and agricultural papers as can be sent them from the Bureau of Agriculture, etc.

The work of these reporters is highly appreciated by us, as it also should be by the State. Crop statistics, above all others, are the most important to the producer, because they inform him of the crop prospects whilst the fruits of his labor are in his own hands, and before the speculator obtains it at much less than its prospective market value.

This method of procuring crop reports through the agency of a corps of volunteer reporters has been adopted generally by other States, but nearly all of them complain of the inaccuracies that occur. A more reliable method, and one far more accurate, would be that of requiring the *Tax Assessors* of each civil district to report the acreage planted to each product; also condition and yield per acre, and also report the number of acres of each and every parcel of land that is in timber, and upon blanks furnished by the Bureau, and return same to the Bureau direct.

CORN.

The early plant of corn on many farms of the State was totally, and on others materially, damaged by the cut-worm. A large area devoted to this staple product required replanting, which was done late in the season, and the drought which prevailed

throughout a majority of the counties retarded its growth and reduced the general average yield. Tennessee produced in 1886 about 58,000,000 bushels, against an average aggregate yield of 62,000,000 bushels. The varieties grown in Tennessee are the White and Yellow Dent, the White Willis, Extra Early Sweet and Hominy. The family of Dent is greatly preferred as a food for live stock and for export, the Willis for bread and the Extra Early for roasting ears.

Big Bottom, Humphreys County, reports a crop of forty acres White Dent that yielded 100 bushels per acre. Mr. Jo. Baugh, of Williamson County, reports his own crop, same variety, at 65 bushels, and says 75 bushels were harvested by some of his neighbors in 1886.

WHEAT.

The acreage sown to wheat in the fall of 1885 was about 8 per cent. less than the average, but the yield was much above, in fact, the farmers throughout the State pronounce it phenomenal. Many private parties report 40 bushels per acre, and very few report less than 25 upon clover lands. The varieties which are preferred by Tennessee farmers are Fultz, Golden Chaff, German Amber, Canada Red, Boughton and Red Mediterranean. A few sow Tappahannock. The Golden Chaff is regarded the most prolific, as it generally produces from four to six grains per mesh, but it is more difficult to reap, because of the silica in the straw. One of our best farmers says that he can, with a good team, reap three or four acres more per day of any other wheat than Golden Chaff. Fultz is largely sown, and produces well, as do German Amber and Canada Red. The Red Mediterranean produces only from two to three grains per mesh, consequently the yield per acre is light, rarely ever more than 15 bushels. It is, however, in great demand for milling purposes. Boughton and the Silver Chaff afford a good yield. The large amount of silica which is complained of by some in the stock of Golden Chaff should prove a great recommendation for it with us, as it will protect it very much against rust, which often destroys much of the crop.

OATS.

An increased acreage was sown to oats, and a larger crop than ever before produced. The varieties most popular are the red, and the black rust proof. The white oat is liked by many farmers, and yields an abundant crop when not attacked by rust. Oat is a valuable crop to the farmer who raises horses for market.

RYE.

There is never a large acreage in Tennessee sown to rye. Much more should be. The yield for 1886 was excellent where the land was properly prepared for the seed.

BARLEY.

But few counties in the State report this crop. It is, however, grown in the counties of Sumner, Wilson, Williamson, Maury and Davidson, and very successfully. One farmer reports 50 bushels per acre—very few under 40 bushels. This should be cultivated for a commercial crop. Farmers would find it remunerative, and if sown early affords excellent pasturage for sheep and other young stock. It is a good grain, and requires less as a feed for horses and mules than any other. Every farmer should have a small field of barley.

STOCK PEAS.

As a fertilizer, many prefer the stock pea to red clover. It is not only one of the best crops for recuperating worn lands and exhausted soils, but the hay of the pea is also an excellent crop for cattle, hogs and mules, and the pea itself a remunerative crop for commerce. It is with pleasure that we note the increased area devoted to the stock pea. It is not only grown in every county in the State, but in some counties it is extensively planted, and is invariably followed with good results to the soil and the bank account of the farmer. The whippoorwill and the Clay seem to be in the greatest demand, but all varieties are good.

RED CLOVER.

To the credit of Tennessee farmers, it may be said a larger acreage of this important crop was sown in the spring of 1886 than ever before in the history of Tennessee, and the yield was also larger. But much of it cut for hay was either totally destroyed or badly damaged by the rains during harvest. A good crop of hay, however, was secured by the persistent effort of the industrious farmer.

Red clover stands at the head of the list as a crop fertilizer, and also as a hay for all classes of live stock. We note with much pleasure that the farmers of West Tennessee have reduced their acreage planted to cotton heretofore, and have substituted red clover. This is a move in the right direction, and if prosecuted will in the end relieve them from the control of the commission merchant. The information reaches us that the twenty-two counties of West Tennessee seeded fifteen thousand acres more of their land to clover in 1885 and 1886 than ever before. The yield of hay per acre on good land reaches two and a half tons, and of seed three bushels.

TIMOTHY.

An increase of acreage and yield reported throughout the entire State. This is as it should be. More grass, more hay—less arable land. The average yield is from one and a half to two tons per acre.

THE GRASSES.

Orchard grass, blue grass, red top or herds grass, and Randall grass or meadow fescue, are all reported—increase of acreage and of yield. The crop of these four grasses in 1886 is believed by the most intelligent farmers to have been the largest ever produced in Tennessee, and preparation has, and will, during the present winter, be made to extend the already large acreage. With a view of rendering every assistance to the farmer so inclined, we have reproduced in this report an article on the best methods for preparing and seeding lands to the

varieties adapted to Tennessee. They are commended to the farmers of Tennessee with the hope that much good will be derived from the study of same. If they will do this and give these grasses a practical test, they will find themselves, five years hence, in greatly improved circumstances. The farmers of East and Middle Tennessee should become a pastoral people. Less of their lands should be cultivated, and more seeded to the grasses. More and better grades of live stock should be raised by them. Less labor will be required, and the fertile soil of their farms will be retained. The plowing of land one time before a heavy rain often results in much of the soil washing off through the channels of little rivulets into larger branches and creeks or rivers, which carry it on to the gulf or the sea.

The farmers of West Tennessee should prosecute the good work inaugurated by them within the past few years, of sowing the grasses, clover, and planting stock peas. Extend these areas from year to year in grasses adapted to their soil; such, for example, as orchard grass upon the more fertile, the herds grass upon the more moist, and Randall grass, with herds grass and clover, upon their poorer lands. They will find within five years that with two horses they can thus cultivate and harvest a crop, live stock included, that will net them from twelve to fifteen hundred dollars annually.

COTTON.

The area devoted to the cotton crop of the State in 1886 was slightly (2 per cent.) below the general average, and the yield reported as 7 per cent. less, which was an improvement on the reports made during the earlier stages of the crop. The improvement in the yield of cotton is due to the unprecedentedly fine season for the maturing and gathering of the crop. The warm and dry fall weather was most favorable, and the reports from the cotton growing section show that the farmers made good use of the opportunity in getting their crops gathered and prepared for market. With the exception of a very small percentage, the crop was gathered in better condition than for

many years, and most of it marketed as soon as it was baled. In a few sections the frost cut short the top crop, thereby reducing the yield; but altogether the crop is reported one of the best ever gathered in the cotton district.

TOBACCO.

The acreage planted to this important commercial crop was 2 per cent. above the general average, and the yield 3 per cent. below. The crop itself is one of, if not the finest ever grown. In some counties—notably, Montgomery, Robertson, and others on the lower Cumberland, and the northern tier of counties in the Western Division—the crop was seriously injured by the frost of the night of the 1st of October. In the two counties named the damage amounted to perhaps 30 per cent. In the counties of the upper Cumberland, and of Greene, Unicoi and Sullivan, East Tennessee—the three last named devoted particularly to the cultivation of the finer grades of white Burley and yellow Prior—but little damage is reported, and the crop is housed in splendid condition.

SORGHUM.

Sorghum is a popular crop in many sections of the State. The reports show a decrease of 4 per cent. in acreage and 7 per cent. in yield.

IRISH POTATOES.

The acreage devoted to this wholesome and profitable crop was 2 per cent. below, and the yield of first crop 2 per cent. above the average, and in the second crop the reports show a decrease of 17 per cent. of yield. The Colorado beetle was very destructive to Irish potatoes in various parts of the State, especially in the Middle Division.

SWEET POTATOES.

The sweet potato, as also the Irish, is planted to a greater or less extent in every county of the State, and is highly appre-

ciated as a winter vegetable. The report of acreage in this crop is only 1 per cent. below the average, and 5 per cent. below in yield.

TURNIPS.

With the exception of the Western Division, which reports a fair yield, this crop is far below the average. The damaging drought reduced the percentage of condition in the early fall, and rains were almost too late to restore the prospects. In the Eastern Division a little over half a crop is reported; acreage sown a full average, and the yield 77 per cent.

PEANUTS.

It is strange that the management of the United States Census Reports of 1880 omitted to make the slightest reference to this crop, which, in some of the counties of Tennessee, and doubtless many in Virginia, North Carolina, South Carolina and Georgia, make their leading commercial crop. The reports from thirty-three counties in the State report an average acreage of 86 per cent. and a yield of 86.

APPLES.

The condition and yield of this excellent fruit and ordinarily profitable crop, is reported at about 63 per cent. of average.

PEACHES.

The phenomenally hard winter of 1885-86 was destructive to this most delicious fruit and remunerative crop, the average yield of which was only 13 per cent. of an average crop.

STRAWBERRIES.

Of small fruits, strawberries have proved a good crop. The cultivation of this berry for market has become quite an industry in many counties, and with favorable conditions, is always very profitable. A correspondent of Franklin County writes that he has strawberries that measure twenty-four to the quart.

GRAPES.

This delicious fruit, like all others, has been injured by the cold winter weather of last winter. In some sections the vines escaped almost entirely, but the average yield was reduced to 62 per cent.

OTHER SMALL FRUITS.

Not unlike the strawberry and the peach and the grape, all other berries and small fruits suffered from extreme cold weather. Average acreage, 95 per cent., and yield, 91 per cent.

MELONS.

This crop resulted in an average of 67 per cent.

BROOM CORN.

There are a number of counties that make broom corn a crop product, and several farmers plant more than one hundred acres the season. The acreage and average yield for 1886 was about 94½ per cent.

CATTLE.

Tennessee is the producer and the owner of more Jersey cows of large butter records than any State in the Union. Here will be found the home of the Shorthorn, the Devon, Sussex, Holstein, Jersey and Polled Angus; also, animals of each of these families, which, for individual merit, cannot be surpassed in America. This is the birthplace and home of Landseer's Fancy, Ethleel 2d, and Lord Harry and Duke of Barrington. It is also the home of Tormentor and Gold Basis, the *par excellence* of the Jersey family.

The report for 1886 shows the condition and increase of all cattle to be fully up to the average.

HORSES.

Kentucky has for years worn the blue ribbon as nursery for the fleet-footed racer, the enduring roadster, the Catalonian jack and his modest but untiring animal of all work—the mule. But Tennessee can now boast that distinguished honor, honestly won by the wise and judicious breeding of all the above strains, and cultivating also the wonderful pacer, which has developed into a speed animal the envy of the world. The famous Luke Blackburn and Bramble were bred and born here, as also Little Brown Jug and Bonesetter. We now have the famed Iroquois at the head of the great Belle Meade breeding establishment, accompanied by Enquirer, imported Great Tom, Plenipo, Luke Blackburn and Bramble; and at the head of the Ewell Farm Trotting Stud, the celebrated stallions Tennessee Wilkes, by George Wilkes; Enfield, by Rysdick's Hambletonian; Nuthill, by Nutwood; Brown Hal, by Tom Hal; and Masker, by Brown Hal. The Hermitage Stud, recently organized, has the celebrated Wedgewood at its head, accompanied by Bonniewood, brother to Nutbreaker, by Nutwood; Philosopher, by Pancost; Rembrandt, by King Rene; Red Fern, by McCurdy's Hambletonian, and Ethiopian, by Electioneer. The Belle Air Stud is topped by Almont Jr. (Bostick's), by Almont.

Thus it will be seen that the horse-breeders of Tennessee are abreast of the times, and possess the best and most fashionable strains and highest type known to Americans.

The reports for 1886 are a full average of condition and increase in horses and mules.

SHEEP.

The clip of Merino wool of Tennessee sheep took the premium over all other contestants at Vienna, Paris, and twice at London, in *ante-bellum* days, and at the Centennial of Philadelphia in 1876, Col. Mark R. Cockrill, of Nashville, being the owner. Tennessee, so favored in all the conditions of soil,

climate, and pasturage for the very highest development of this industry, is far behind other States in laws for its protection. In some of the largest wool-growing districts the farmers have already abandoned it. The interest in sheep-growing, sad to state, is gradually dying out, and unless something is done by the Legislature to protect the farmer in this branch of husbandry, a few years will witness almost the entire extinction of this pleasant and remunerative industry.

The report for 1886 shows an average decrease in numbers of 10 per cent., and yield of 4 per cent.

HOGS.

The report of the hog crop is 4 per cent. less than an average crop, and 5 per cent. less in condition. Hog cholera is reported in about half the counties of the State. The counties reporting greatest prevalence of the plague are: Anderson, Bledsoe, Blount, Carter, Clairborne, Granger, Greene, Hancock, Hawkins, Johnson, Knox, McMinn, Meigs, Rhea, Scott, Sevier, Union and Washington, in Eastern Division; Bedford, Cheatham, Clay, Coffee, DeKalb, Giles, Grundy, Hickman, Humphreys, Lewis, Marshall, Montgomery, Moore, Perry, Putnam, Van Buren, Warren, Wayne and White, in the Middle Division, and Decatur, Dyer, Hardeman, Hardin, Madison and Shelby, in the Western Division. In only two counties—Anderson, in the Eastern Division, and Lewis, in the Middle Division—is any disease among other stock reported. These counties report prevalence of the distemper among horses.

COMMERCIAL FERTILIZERS.

Your attention is respectfully called to a clerical error which occurs in the second section of an act passed March 24, 1883, governing the "inspection and sale of commercial fertilizers in Tennessee," viz: The word "American potash" appears in the text, when it should read "*ammonia and potash*." This error was made by the engrossing clerk when copying the original manuscript, and should be corrected.

THE FERTILIZER LAW,

to be effective, should be amended in such manner that the inspector of fertilizers be authorized to inspect the shipping books of any and all railway companies when, in his judgment, it may be deemed necessary to prevent or detect fraud in the shipment of fertilizers that have not been inspected, and upon which the tax tag has not been placed.

PLEURO-PNEUMONIA.

During the month of January, 1885, Commissioner Loring, of Washington, D. C., by telegraph, notified Your Excellency that a car load of Jersey cattle infected with pleuro-pneumonia had been shipped by Dr. Hamilton, of the Jackson Jersey Breeders' Association, Jackson, Tenn., from the neighborhood of Christiana, Ky., to Jackson, Tenn. The Legislature being at that time in session, was notified of this fact, when it immediately passed the following House Joint Resolution No. 1:

WHEREAS, The Governor has been officially notified by Commissioner Loring that a car load of Jersey cattle infected with pleuro-pneumonia has been shipped to Jackson, Tenn.; therefore,

Resolved, by the General Assembly, that the Governor be requested to immediately quarantine these cattle in the present location, to the end that the cattle of the State may be protected against this infectious disease.

A copy of which, inclosed with the following letter from you, was mailed at once to the Sheriff of Madison County, Tenn.:

EXECUTIVE OFFICE,
NASHVILLE, TENN., January 1, 1885. }

I, as Governor, by authority of this resolution, here direct you, as Sheriff of our County of Madison, to take this matter in charge without delay, and see that the said cattle are safely and securely put under quarantine, as directed by said resolution.

You will, as soon as practicable, report to the Governor the situation of said herd of cattle and what you have done in the premises. Information has been received at this office that the cattle in question are on the farm of Dr. Hamilton, near Jackson, and are already impounded. In case they are not safely and securely confined within proper limits, and so surrounded by outer fences or other safeguards that stock from without cannot approach within infectious range of them, you will see that the cattle are so kept until further orders from this office.

WM. B. BATE, Governor.

In pursuance of the foregoing order, the cattle have been, since its issuance, under strict quarantine, and have been several times inspected by a United States veterinarian in the presence of the State Live Stock Sanitary Commission.

Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, at Washington, in his report August 10th last, says: "It seems to me that the long period of time which has elapsed since there was any active form of the disease, is sufficient to warrant us in concluding that the contagion no longer exists in this herd. I believe there is no reason for placing any further restrictions on the free movements of this herd, and I would recommend that the restrictions now in force in regard to it be removed." Whereupon, the Live Stock Sanitary Commission of the State, at a meeting held September 7, at the office of the Governor, report:

NASHVILLE, September 7, 1886.

To His Excellency, WM. B. BATE, Governor of Tennessee:

SIR—The undersigned, members of the Live Stock Sanitary Commission of the State of Tennessee, have met this day, in obedience to your summons, and have had under consideration the annexed letter to you from Dr. Salmon, United States Veterinarian, as to the condition of the cattle belonging to Hamilton, Timberlake, and others, now in quarantine near Jackson,

Tenn. We respectfully state that, in our opinion, the clearly-expressed opinion of Dr. Salmon that the cattle should be released makes it your plain duty, under the laws of the State, to order the raising of the quarantine and the removal of all restrictions now affecting said cattle. Respectfully submitted.

F. B. SWIPES,
 CAMPBELL BROWN,
 J. V. FULKERSON,
 Tennessee Live Stock Sanitary Commission.

Governor Bate sent the Sheriff of Madison County the following order:

QUARANTINE RAISED.

EXECUTIVE OFFICE,
 NASHVILLE, TENN., September 10, 1886. }

To the Sheriff of Madison County and to Jno. F. Byrd, guard:

From the reports of Dr. Salmon, Chief of the Bureau of Animal Industry, at Washington, and of the Tennessee Live Stock Commission, it appears that there is no contagion existing in the herd of Jersey cattle at Dr. Hamilton's farm, in your county, the same that you have held under quarantine since January 31, 1885, as per my order of that date, issued under legislative resolutions; and it being recommended by both Dr. Salmon and the State Live Stock Sanitary Commission that the said cattle be relieved of further restrictions, and the quarantine raised;

Now I, therefore, as Governor, in accordance with the recommendations aforesaid, believing it perfectly safe to do so, especially as no evidence of such disease has presented itself at any time during the twenty months they have been under quarantine, hereby direct that you release the said cattle from the quarantine under which they have been held, and that you surrender them into the custody of their owners.

WM. B. BATE, Governor.

PROCLAMATION OF WARNING AGAINST THE IMPORTATION OF CATTLE
FROM THE STATE OF ILLINOIS.

STATE OF TENNESSEE, }
EXECUTIVE OFFICE, NASHVILLE. }

Whereas, it has come to my knowledge that the cattle disease known as contagious pleuro-pneumonia exists among the cattle of the State of Illinois, particularly in the city of Chicago and its vicinity;

And whereas, it appears from proclamations of the authorities of several States that said States have quarantined against the importation of cattle from the State of Illinois on account of the existence there of pleuro-pneumonia;

And whereas, the General Assembly of the State of Tennessee, at its extraordinary session in 1885, enacted a law (ch. 9, page 69) providing for a Live Stock Sanitary Commission, and for the quarantine and slaughter of animals in this State affected with pleuro-pneumonia, or that have been exposed to the same, in the manner therein pointed out; also an act (ch. 18, page 93, of the same acts), among other provisions, making it a misdemeanor punishable by a fine of from \$100 to \$5,000, and by imprisonment from ten to thirty days, at the discretion of the Court, for any person to bring into this State any cattle, knowing the same to be affected with pleuro-pneumonia, or to have been exposed to such disease; or for any person knowingly to be in any way concerned in bringing into the State any cattle affected with said disease, or that have been exposed to the same.

Now, therefore, in order to prevent the irreparable damage to the interests of this State that would result from the introduction and spread of this destructive disease, I, William B. Bate, Governor, having no legal authority to proclaim a quarantine, hereby warn all persons against bringing into the State of Tennessee any cattle affected with such disease, or that have been exposed to the same, and warn all persons that, in the event of the introduction of any such cattle, energetic steps shall be taken to promptly enforce the provisions above referred to.

I request all citizens of the State to aid in preventing the introduction and spread of this disease, and to make known to me, at this office (by affidavit, as the law requires), any infraction of the law in this respect that may come to their knowledge.

WM. B. BATE, Governor.

Hon. B. G. Allison, of Brownsville, Tenn., by letter addressed your Excellency, under date 22d November, 1886, inclosing affidavit of Mr. J. R. Head, stating that he believed his herd of cattle on farm some two and a half miles from Brownsville, was affected with pleuro-pneumonia, on receipt of which the members of the State Sanitary Commission were, by telegram, requested to meet Dr. N. H. Pearson, U. S. Veterinary Surgeon, at Brownsville on the 27th, and inspect the herd of cattle belonging to Judge Allison. The following report was made by the Sanitary Commissioners, which is respectfully submitted:

NASHVILLE, TENN., November 29, 1886.

To His Excellency, WM. B. BATE, Governor of Tennessee:

DEAR SIR—Pursuant to your telegram of 25th inst., we proceeded to Brownsville to inspect the herd of cattle belonging to B. G. Allison, near that place, reported by him to have what was believed to be pleuro-pneumonia. We were there met by State Commissioner of Agriculture A. J. McWhirter, and Dr. N. H. Pearce, U. S. Veterinary Surgeon. With the said gentlemen we proceeded immediately to the premises of Mr. B. G. Allison, distant about two miles, and made a careful inspection and examination of his herd of cattle, supposed by him to be affected with pleuro-pneumonia. At his (Allison's) request we had one of the animals slaughtered, and made a thorough *post-mortem* examination. The animal showed no sign of pleuro-pneumonia, or other organic or contagious disease, but seemed to be suffering from general debility and malnutrition, brought on entirely from some local cause. Respectfully submitted,

F. B. SWIPES,

J. V. FULKERSON.

From the preceding reports of two distinguished veterinary surgeons employed by the Commissioner of Agriculture, Washington, D. C., and the State Sanitary Commission, it will be seen that there is not a case of pleuro-pneumonia to-day in Tennessee.

GEOLOGY OF TENNESSEE.

I cannot too strongly recommend the publication of a new edition of Dr. Safford's Geology of Tennessee. The work has been pronounced to be one of the best of its kind published in any State. A Southern State Geologist of high standing, whose name I could mention, once said: "I desire to live long enough to publish for my State a book like Safford's Geology of Tennessee." Dr. Sterry Hunt, before the American Association for the Advancement of Science, at its meeting in Nashville some years ago, stated that the classic work of Dr. Safford was a credit to the State of Tennessee. The book has been the basis of nearly all that has been published in the Mineralogy and Geology of Tennessee.

The book is now out of print, and cannot be had for love or money, and yet the demand for it is very great, and applications for copies are increasing, and come from every quarter. It is truly a book very much needed, indeed, I may say indispensable. A new edition brought up to date and completed, as only Dr. Safford can complete it, will have still greater value and redound every way to the credit of Tennessee.

Dr. Safford is State Geologist without a paid salary, but has performed excellent work in the field and in his laboratory for the State at a minimum cost to the fund of the Bureau. He could, within the next two years, complete the field, including the principal mineral springs of the State and prepare the manuscript for a revised edition of Safford's Geology of Tennessee at an expense of two thousand dollars.

The report of Dr. Safford upon the General and Agricultural Geology of Tennessee, found incorporated in this work, is of great value, and should be carefully read and studied by all who feel interested in the material development of Tennessee.

ENTOMOLOGY.

The report of Prof. E. W. Doran, Assistant Entomologist, occupies, as it should do, a conspicuous place in this Biennial Report. It is the first report upon the entomology of the State that has emanated from this Bureau, and should commend itself to the farmers and scientists alike for its research into the history and habits of those noxious insects that infest the fields, the orchards, the gardens and the pastures. The report of Prof. Doran is exhaustive upon the history of all the insects referred to by him; and the remedies recommended by him for their destruction should be adopted by every farmer, gardener and orchardist of the State.

As suggested by your Commissioner in his first Biennial Report, the State of Tennessee would save thousands of dollars per annum to its farmers by employing an expert in the science of entomology to look after and devise methods to prevent, or to destroy, the myriads of bugs and other insects that feed upon the forests, the crops and the animals of Tennessee. The ravages of the Hessian fly, the Colorado beetle and the Buffalo gnat, of themselves destroy some years much more than one hundred thousand dollars in value of wheat, Irish potatoes and live stock. A report less exhaustive and much less elaborate than Prof. Doran's has cost some States of the Union more than two thousand dollars. The Entomologist should receive a sum as salary that would enable him to make a collection of the various insects injurious to vegetation and animals in all their stages, with the crops they injure, to become the property of the State and be placed on exhibition in the Bureau.

OTHER REPORTS.

The report of John W. Glenn, Professor of Chemistry and Director of Experimental Station University of Tennessee, is in the right direction, as it proceeds from a practical as well as a scientific mind. It is brief, but full of food for the practical farmer, and will be valuable as a work of reference. Prof. Glenn deserves great credit for the zeal manifested in advanced agriculture.

Col. C. W. Charlton, Assistant Commissioner of East Tennessee, whose report will be found in this work, deserves also great credit for his industry and persistence in holding up the hands of the farmers and business of his section in everything looking to the material development of Tennessee. His report is worthy the careful consideration of all men in every section of the State.

The reports of the East Tennessee Farmers' Convention—composed of about 800 leading farmers of East Tennessee—for 1885 and 1886 are commended to readers of every class and condition who wish to be entertained. No subject can escape the wide-awake East Tennessee farmer.

The report of the Interstate Convention at Jackson, Tenn., is full of reading matter, and should command the attention of all. The addresses delivered on that occasion by the practical farmers of the North and South will compare favorably with those delivered by any body of men in any section of the Union.

The reports of county fairs, live stock of the State, catalogue of cotton and of the woolen mills of the State, and of the principal industrial cities of Tennessee are all worthy consideration.

The exhaustive, instructive and most interesting reports (three in number) of Jo. C. Guild, Inspector of Mines, are commended to your most careful consideration. Mr. Guild has inaugurated a new era in mine inspection, and although but quite young, has sprung to the first position in his department of scientific labor. His reports speak for themselves, and should be read by all who are interested in mining pursuits. Orders for these reports are sent us from every State in the Union that is engaged to any extent in mining.

TABLE No. 1.—*Showing Percentage of Acreage of Various Crops as with full Average Crops; also Percentage of Number*

1885. MONTHS.	WHEAT.		CORN.		OATS.		CLOVER.		GRASS.		COTTON.		TOBACCO.		SORGHUM.	
	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.
April.....	74	143	104	96	107	95	94	83	96	90						
May.....		40	108	94		88		81		87	92	85	101	92	94	93
June.....				105		98						95	103	95		98
July.....		*36		114		*100		*88		*97		95		97		98
August.....				105								93		95		97
September.....				97								85		91		98
October.....	81			*96					90			*83		*95		*99
November.....	87			*96		375	95		90			*80				

*Percentage of yield compared with average crops.

†Late crop.

‡Damage by frost reported 56 per cent.

§Winter oats.

||Eight per cent. killed by dogs.

Compared with 1884, and Percentage of Condition of same as Compared and Condition of Live Stock as Compared with 1884.

IRISH POTATOES.		SWEET POTATOES.		TURNIPS.		PEANUTS.		APPLES.		PEACHES.		SMALL FRUITS.		HORSES AND MULES.		CATTLE.		SHEEP.		HOGS.	
Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.
99	96	94	94			92	91	108		118	100	99		98	91	96	88	90	87	89	91
	99	96	97				97	101		119		100									
	99		96				98	98		118		100									
	96		93	97	86		92	97		102		96									
	174		88		61		88	96		*102		*90									
	*73		*89		62		*69	*97		*100											
					*68																
															102		100		99		100

TABLE No. 2.—*Showing Percentage of Acreage of Various Crops as with full Average Crops; also Percentage of Number*

1886. MONTHS.	WHEAT.		CORN.		OATS.		CLOVER.		GRASS.		COTTON.		TOBACCO.		SORGHUM.	
	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.	Average, Per Cent.	Condition, Per Cent.
April	87	112	98	94	105	100	102	102	101	101	.....	.....	.....	.....	.....	.....
May .....	.....	108	99	91	.....	100	.....	99	.....	100	98	96	101	97	96	95
June .....	.....	.....	.....	88	.....	106	.....	.....	.....	.....	93	102	98	.....	92	.....
July .....	.....	*98	.....	84	.....	*106	.....	*95	.....	*102	.....	85	.....	94	.....	88
August .....	.....	.....	.....	84	.....	.....	.....	.....	.....	.....	94	.....	93	.....	90	.....
September .....	.....	.....	.....	90	.....	.....	.....	.....	.....	.....	89	.....	98	.....	91	.....
October	92	.....	.....	*88	.....	.....	.....	.....	91	.....	*93	.....	*97	.....	*93	.....
November	95	.....	.....	*87	†87	.....	.....	.....	91	.....	*97	.....	.....	.....	.....	.....

* Percentage of yield compared with the average crops.

† Late crop.

‡ Winter oats.

§ Ten per cent killed by dogs.

Compared with 1885, and Percentage of Condition of same as Compared and Condition of Live Stock as Compared with 1885.

LEEK POTATOES.		SWEET POTATOES.		TURNIPS.		PEANUTS.		AP- PLES.	PEACH- ES.	SMALL FRUITS.		HORSES AND MULES.		CATTLE.		SHEEP.		HOGS.	
Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Condition, Per Cent.	Condition, Per Cent.	Acreage, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.	Number, Per Cent.	Condition, Per Cent.
98	96	99	98			86	92	75	11	100	98	100	99	100	96	90	96	94	98
	99		96				80	69	12		90								
	101		94				85	66			80								
	*102		94	100	90		83				75								
	138		96		87						*65								
	*87	*96			83	*86	*56												
				*77								100		100		296		95	

TABLE Showing in Inches the Average Monthly Rain-fall in Tennessee for the Years 1883, 1884, 1885 and 1886.

MONTHS.	1883.	1884.	1885.	1886.	Mean of Four Years.
January -----	6.18	6.55	6.96	5.06	6.19
February -----	4.32	8.45	2.39	3.80	4.74
March -----	4.46	7.90	2.34	6.48	5.29
April -----	6.89	4.95	2.75	3.61	4.55
May -----	3.87	3.58	4.27	4.42	4.04
June -----	4.77	5.30	4.19	7.24	5.37
July -----	3.88	5.55	4.34	3.26	4.26
August -----	3.43	2.08	2.30	4.05	2.97
September -----	2.06	2.07	3.80	3.11	2.76
October -----	5.24	2.26	3.73	0.97	3.05
November -----	4.22	1.56	4.10	6.39	4.07
December -----	4.31	5.32	3.19	-----	(3 years) 4.27
Sums -----	53.63	55.57	44.36	-----	-----
Means -----	4.47	4.71	3.73	4.40	4.30

TABLE Showing the Average Monthly Temperature for Tennessee for the Years 1883, 1884, 1885 and 1886.

MONTHS.	1883.	1884.	1885.	1886.	Mean of Four Years.
January -----	40° 55	29° 45	33° 58	30° 47	33° 51
February -----	45° 85	45° 0	33° 77	36° 56	40° 29
March -----	47° 55	49° 0	42° 57	47° 16	46° 56
April -----	59° 2	55° 57	59° 34	58° 29	58° 10
May -----	64° 5	66° 42	64° 53	67° 04	65° 62
June -----	73° 0	72° 0	74° 60	71° 54	72° 78
July -----	74° 0	76° 0	77° 21	75° 37	75° 64
August -----	72° 0	73° 6	75° 80	75° 6	74° 22
September -----	67° 5	73° 2	69° 52	70° 4	70° 15
October -----	62° 22	63° 73	54° 44	57° 1	59° 37
November -----	49° 42	45° 1	47° 23	46° 2	46° 99
December -----	42° 87	39° 14	39° 41	-----	(3 y'rs) 40° 47
Means -----	58° 18	57° 53	56° 0	57° 79	56° 97

INSUFFICIENT FUNDS FOR THE BUREAU.

As I have definitely determined to sever my connection with the Bureau of Agriculture, Statistics and Mines at the close of my present term, interested motives cannot be attributed to me for again suggesting to Your Excellency the necessity of additional funds for this Bureau. With an experience of near four years in the faithful discharge of its duties and obligations, and full knowledge of the abundant good flowing to the State therefrom, I am thoroughly satisfied that the Commissioner could accomplish more in the matter of general encouragement to the farmers, and also in the work of determining an industrious and enterprising class of immigrants to the State if more funds were placed at his command. An appropriation of not less than fifteen thousand dollars per annum should be made for this department. Without that sum the Commissioners will not be able to employ a sufficient force to accomplish the great objects for which this Bureau was established. Even in its infancy it was given as much financial aid as it now receives. Year by year its scope has widened, its influence has grown, its power has extended, until the work attached to its various departments is ten fold greater than it was eight years ago. The brief history contained in this report of the material development that has been accomplished within the past two years, is an evidence of what may be expected of my successor.

With the amount mentioned above, the Commissioner could afford to employ Dr. Safford in the matter of preparing manuscript for the Revised Edition of Safford's Geology of Tennessee; a work very much needed, and one that Tennessee cannot well do without; he could afford to give constant employment to an Assistant Entomologist, at least for the next biennial term, and he could employ the necessary assistants for discharging the rapidly increasing work of the Bureau, much of which cannot now be performed on account of the inadequacy of funds.

STATEMENT.

On hand Dec. 19, 1884.....	\$1,582 85
1885.	
June 10—Received of State Treasurer	2,625 00
June 16—Received of State Treasurer.....	2,625 00
Sept. 19—Received of State Treasurer	2,625 00
Dec. 16—Received of State Treasurer.....	2,625 00
1886.	
Mar. 16—Received of State Treasurer.....	2,625 00
June 21—Received of State Treasurer.....	2,625 00
Oct. 2—Received of State Treasurer	2,625 00
Total received.....	<u>\$19,957 85</u>

CREDITS.

By amount expended from Dec. 19, 1884, to Dec. 19, 1886, as per vouchers on file in Bureau.....	19,587 29
Balance on hand Dec. 19, 1886.....	<u>\$370 56</u>

COMPLIMENTS AND REGRETS.

This closes the Commissioner's report for the year 1886, and his official report for the second biennial term of office. In taking leave in an official capacity of our assistants in the humble, but important, work which we have endeavored faithfully to perform, we desire to offer our most sincere thanks for their kindness, courtesy, confidence and promptness, to Dr. J. M. Safford, Dr. A. Gattinger, Prof. E. W. Doran, H. C. Bate, C. W. Charlton, Robt. Gates, Louis B. McWhirter, Jo. C. Guild, Prof. J. W. Glenn and Horace Kercheval, Esq.

To the corps of crop correspondents, numbering, at certain seasons of the year, some eight hundred enthusiastic farmers, we tender our most profound acknowledgments for the kindness and promptness with which they have voluntarily served

the Bureau and the State during the past four years, and for their hearty co-operation in the work of making crop statistics, without which it would have been almost impossible. If our part of the work has been successful or satisfactory, we shall feel fully repaid. With the kindest and best wishes for each and every one of our assistants and crop correspondents, and with an earnest prayer for the continued prosperity of our grand old State,

I am, respectfully,

A. J. McWHIRTER,

Commissioner.

THE
Economic and Agricultural Geology
OF THE
STATE OF TENNESSEE.

*A Report on Surveys Made in West and Middle Tennessee, and on
the General Agricultural Geology of the State.*

BY JAMES M. SAFFORD, STATE GEOLOGIST.

REPORT.

To the Hon. A. J. McWHIRTER, Commissioner:

SIR—I have the honor to present herewith my report on the General and Agricultural Geology of the State, embodying the results of systematic and special work done in the field and in my laboratory at intervals, from 1880 to the close of 1886. The field work has for a number of years been confined to the summer months, and for this only has remuneration been allowed. The laboratory work has been chiefly gratuitous. The report, you will find, is divided into two parts, as follows: Part I. A special report on the geology of parts of West Tennessee, giving results of work completed and statements as to work in progress and unfinished, together with an account of certain mineral veins in Middle Tennessee; and Part II. A report upon the Agricultural Geology of the State. Most of the second part has appeared elsewhere, but it is desirable that it be published as a part of a bound volume, and at the same time be made easily accessible to the people of the State. The subject matter was in the main worked up by myself as special census agent on cotton production for 1880 in Tennessee and Kentucky. The sources of information have been my own published works, the answers and notes of correspondents, and personal observations made in the field.

I beg further to call your attention, as I did two years ago, to the fact that a new edition of the work, known as the Geology of Tennessee, is very desirable, and even demanded. The book was issued in 1869—seventeen years ago. It is now wholly out of print, and copies cannot be even purchased. As you well know, the Governor and yourself are constantly appealed to for copies. Applications are often made to me, and

it is a matter of regret, and even chagrin, that I cannot meet them. The applications come from parties interested, or desiring to become interested, in the lands and minerals of the State, from teachers, scientific men, librarians and others, at home and abroad. Much new matter has accumulated since 1869, to be incorporated in a fresh edition of the work, which thereby would be made the more useful.

I trust you may find it consistent with your views to call the attention of the Governor and the Legislature to the desirability of a new edition of the work mentioned.

Very respectfully,

JAS. M. SAFFORD,

State Geologist.

PART I.

A SPECIAL REPORT ON THE GEOLOGY OF PARTS OF WEST TENNESSEE, GIVING RESULTS OF WORK COMPLETED, AND STATEMENTS AS TO WORK IN PROGRESS AND UNFINISHED, TOGETHER WITH AN ACCOUNT OF CERTAIN MINERAL VEINS IN MIDDLE TENNESSEE.

While explorations have been made in all three of the divisions of the State, West Tennessee has received for the last two seasons the largest share of attention. This is no more than just, for heretofore this division of the State has hardly received the consideration and service to which it was entitled.

The question is sometimes innocently asked, "What is there worthy of note in the Geology of West Tennessee?" "What's there for the geologist?" To this I would give promptly the broad answer: Much, every way. Yes, much of practical as well as of scientific interest. Leaving out of the account its limestone portion skirting the Tennessee River, with the iron ores, hydraulic lime rocks and marbles pertaining to it, West Tennessee has its strata and formations quite as markedly as Middle and East Tennessee have theirs. Its sands, clays and marls lie in strata like the limestones and sandstones of the divisions mentioned. The mere fact of their being unconsolidated or "soft" does not throw them out of the category. The strata here, as elsewhere, supply the soils of the respective regions, and the study of them enables us the better to know the soils, to classify, to use, and to tell of them. And what a paramount interest is this! Then as the East has its marbles, so the West has its clays, of great and growing importance; no mean heritage, as will some day be seen, for numerous beds exist, many extensive, suited to the varied purposes for which clays are used. These it becomes us to look after more than

has been done. Further, there are the unique quarries of red sandstone in the high points and ridges, the marls, the lignites, the gravels, the available sands, both white and orange-colored, already exported, and the invigorating, healing chalybeates of so many counties. All these, to add no more, are native resources of West Tennessee, the bringing out of which well deserves attention. Again, putting ourselves on a different platform, if not a higher one, West Tennesseans, like all of us, should be informed as to the land they live in, without regard to immediate "*cui bonos*." They should know something of its internal structure and exterior configuration, its formations, topography, water-supply, drainage, etc., if pretense is made to a respectable intelligence. Their children must have like information, and more of it than their fathers. School and text-books should be of the kind to guide them in the acquisition. For all this reliance is mainly on geological work. Further, contrary to the opinion of many, the geology of West Tennessee presents many problems of great scientific interest, and not a few of them hard knots to be loosened—work for well trained and active heads and hands.

Explorations in West Tennessee were chiefly made along the following railroads: The Chesapeake, Ohio and Southwestern, Louisville and Nashville, Nashville, Chattanooga and St. Louis, and the Mobile and Ohio. Parts of Henry, Benton, Carroll, McNairy, Hardeman, Gibson, Dyer, and Obion, away from the railroads, were also surveyed.

THE OLD SHORE LINE.

Before proceeding further, it becomes necessary to trace out a well-marked line of separation or of junction, which I have designated the Old Shore Line. The Gulf of Mexico once extended in an arm northward as high as Cairo, at the mouth of the Ohio River, covering with its waters much the greater part of the area we now call West Tennessee. The waters dashed their waves, on the eastern side, against a sloping, rocky shore. In time the depths of the arm became filled up with wide-spreading layers of clays and sands, the whole country was

slowly raised, the waters retired, and the clays and sands became dry land. The course of this ancient rocky shore can be easily made out. It extends, in a nearly straight line, approximately north and south, quite through the State. This is the "Old Shore Line." It divides the limestones, flints, and shales characteristic of Middle Tennessee and of the eastern part of the State from the clays and sands of West Tennessee—the old from the new. It is a line of junction as well; for these far older limestones, flints and shales are overlapped along its course by the younger clays and sands.

In tracing the Old Shore northerly from the State of Mississippi to Kentucky, we find that it lies a little to the west of the Tennessee River, the two being approximately parallel. Nowhere does it coincide with the bed of the Tennessee, excepting for a distance of about eighteen miles in Hardin County. Along this portion of the river are Pittsburg Landing, Crump's Landing, Savannah, and the county-seat of Hardin, and farthest north, Coffee Landing. Pittsburg Landing, made memorable by stirring events in the late Civil War, is on the west side of the river, and its gravelly, sandy, and clayey bluff belongs to the younger formations, while, at the same time, the limestone bluffs of the opposite and east side of the river belong to the old. The county-seat (Savannah) is on the east side and about on the Old Shore. Crump's and Coffee Landings are on the west side, and are substantially a repetition of Pittsburg Landing, both as to character of bluffs and formations. Passing Coffee Landing, the river and the Old Shore line no longer coincide. The latter, in its northerly course, passes just west of Decaturville, in Decatur County, and of Camden and Big Sandy Station, in Benton. The first two places may, in fact, be considered as located on the Shore itself. It then bends more to the east, approaching, in Henry County, within two miles of the mouth of Sandy and Paris Landings. From this region its direction is parallel with the river to the Kentucky boundary. As to the Tennessee, it will be seen that, with the exception of the eighteen miles of its course in Hardin County, the river has cut its bed through the older rocks, and, curiously, just within their area, all the way across the State.

FORMATIONS WEST OF THE OLD SHORE.

For purposes of reference, the following enumeration and notices of the formations outcropping in West Tennessee, west of the Old Shore line, will be found useful. They are numbered in descending order—that is to say, No. 1 is the topmost and the most recent and No. 9 the lowest and oldest:

1. *Alluvium* of rivers, always at the top when other formations are present.
2. *Yellow Clay Loam*, a superficial formation, ranging from a few inches in thickness to eight or ten feet; often found over large areas, covering other formations.
3. *The Loess, or the Bluff Loam*, a fine ashen-colored, or light-yellowish, siliceous earth, more or less calcareous, and of remarkable properties; the principal upland formation of the tier of counties, including Obion, Dyer, Lauderdale, Tipton and Shelby, ranging from 20 to 200 feet or more in thickness.

Its colors show its materials to be in a peroxidized state, and hence quite in contrast with the dark materials of the Lignitic Group and other lower groups.

4. *The Orange Sand or Drift*, a wide-spreading formation of orange, reddish, and otherwise variegated sands, often including beds of gravel, and locally of white and variegated clays. The sands are most generally loose, but with them we often find brownish-red layers of sand, from one to ten feet thick or more, which have been compacted, or more or less hardened, by an admixture of a small proportion of ferruginous or clayey matter. These layers do not easily wash. When resting on loose sands they become undermined and fall in masses. Further, the formation often supplies quarries of veritable red sandstone. These are local, and mostly found near the tops of high points and ridges. Scattered shelly or thin flaggy sandstones are met with in places.

The Drift outcrops from under the Loess, and spreads widely over the midland and eastern counties of West Tennessee, while it in turn is often covered with the Yellow Clay loam. Thickness exceeding variable, reaching sometimes 200 feet or more.

The materials of the Drift, like those of the Loess, are in a peroxidized state, as shown by its orange, red and yellow colors.

5. *The Lignitic Group* (LaGrange), a great formation usually buried beneath the Orange Sand, and in this position occurring throughout much the larger part of the area of West Tennessee under consideration. In the Obion and Shelby tier of counties, it has, in addition to the Orange Sand or Drift, the fine siliceous Loess resting upon it. Being thus covered, its outcrop con-

tributes little to the general surface or to the soils. Indeed, it is but little seen in natural exposures. In digging wells it is sometimes penetrated. Its mass consists of grayish sand thinly interstratified with shaly clay, the whole often dark with vegetable matter. Impressions of fossil leaves abound in it. Now and then beds of lignite, and the silicified or petrified trunks of trees are encountered. The thickness of the group is unknown; it may reach 1000 feet or more.

6. *The Flatwoods Clay.* This is a series of laminated or slaty clays, of dark color when wet, but light gray when dry. The clays are locally known as "soapstone." Sand showing scales of mica is sometimes thinly interstratified with the clayey laminæ. The thickness of the group is perhaps 200 or 300 feet. The dip is to the west, the whole running under the Lignitic Group. The clay is well seen in the vicinity of Paris, in Henry County; at Huntingdon, in Carroll; seven miles east of Bolivar, in Hardeman; as well as on the Memphis & Charleston Railroad west of Middleton. These points give the direction of the outcrop of the group, the area of which is narrow. It extends quite across the State, with a width rarely over six miles, and often under this. The name *Flatwoods* was given to the formation by the Mississippi geologists. It is not especially descriptive of the formation in Tennessee, for the topography of the latter is more frequently broken and hilly than otherwise. In the northern part of Henry, however, as one enters Kentucky, it does supply a "flatwoods" country.

Most of the outcrop of the formation is free from the covering of the Orange Sand.

7. *The Ripley Group.** The outcropping area of this group lies next east of that of the Flatwoods Clay. It makes a wide belt of the surface, extending from Mississippi to Kentucky, through the southeastern part of Hardeman; parts of McNairy, Chester and Henderson; the eastern parts of Carroll and Henry, and the western part of Benton. In Henry and Benton it lies along the Old Shore line, its beds overlapping here what was once a rocky coast. The thickness of the group is not less than 400 or 500 feet, and may be much more. The formation dips to west and disappears under the Flatwoods clay.

It is a great series of dark-gray, thinly laminated sands and clays, the sands predominating. Now and then a bed of shaly clay occurs. Leaves and leaf impressions are often met with, and at a few points beds of lignite. The mass is usually dark in color, made so by the vegetable matter present. The above are generally features; in places it presents other and exceptional phases. In the Southern part of Hardeman it includes a bed of fossiliferous, impure limestone, from two to six feet thick, and a bed of clayey, calcareous sand, containing green grains and shells (green sand).

Much of the outcrop of the formation, or rather of what otherwise would be the outcrop, is covered by the drift, though large areas occur without it.

* So named from Ripley, Miss., by the Mississippi geologist.

8. *Rotten Limestone (Green Sand)*. This formation is well characterized and easily recognized by the fossil shells (among them great oyster shells) which abound in it. In exposed natural outcrops, it is a fine, grayish, slightly yellowish material, but when deeply penetrated, as in boring wells, or in deep railroad cuts, it is greenish gray and sometimes dark green. The name comes from the Alabama and Mississippi geologists. It has in these States the appearance often of a soft, chalky limestone. Its mass is a mixture of fine sand, clay and calcareous matter—a sort of marl. The green color is due to the presence of soft green grains, having about the consistence of grains of powder.

The formation is well seen about Corinth, Mississippi. From this region its outcrop extends in a broad belt northward into Tennessee, showing itself in the eastern parts of McNairy and Henderson Counties and in the extreme western parts of Hardin and Decatur. It has not been recognized north of Henderson and Decatur. The formation dips to the west. Its maximum thickness (350 feet) is in McNairy.

9. *The Coffee Sand*. This is the lowest and oldest of the formations it is proposed to notice. In the more southern counties, Hardin and Decatur, its layers of sand abut against the hard rocks of the Old Shore, as do the sands of the Ripley group in the more Northern counties, Benton and Henry. The formation is a series of laminated sands bearing mica-scales. Interstratified with the sands are often thin, papery layers of dark clay, the clay layers now and then predominating. The mass abounds in woody fragments, leaves and sticks, converted into lignite. Silicified trunks of trees are also met with. The thickness is unknown; the part exposed shows about 200 feet. The whole dips at a small angle to the west, disappearing under the rotten limestone. Like the Lignitic Group, its outcrop is very generally concealed by the material of the Orange Sand.

In tracing out the Old Shore line on a previous page, it was stated that, for a distance of eighteen miles in Hardin County, the Old Shore and river coincide. Within this distance on the west side are the three landings, Pittsburg, Crump's and Coffee, located severally at the base of as many precipitous bluffs. These bluffs are great bodies of the Coffee Sand formation. The river washes all of them. At Coffee Landing the face of the bluff supplies an interesting section of the formation, and hence the name Coffee Sand. All the bluffs are capped off with the gravel and the finer material of the Orange Sand. I may add here, that beds of gravel, overlying all else but the alluvium, are very often met with in the vicinity of the Old Shore line on both sides, quite across the State.

In this review of the formations, west of the Old Shore, it will have been observed, doubtless, that three of the formations, the Lignitic, the Ripley and the Coffee Sand, present, in their

laminated sands, thin leafy clays and lignitic contents, general features much alike, and, were it not for the interpolated Flatwoods Clay and the Rotten Limestone, might be thrown together as a single great group. They differ, however, in age, and the two interpolated members subserve a good purpose as horizons of separation and of reference. As to the age of the formations, in general the four first, the Alluvium, Yellow Clay loam, Loess and the Orange Sand, or Drift, belong to the fifth and sixth Quarternary division of geologists; the Lignitic group and the Flatwoods Clay, to the Tertiary; and the three remaining, the Ripley, Rotten Limestone and Coffee Sand, to the Cretaceous.

THE COUNTRY ALONG THE CHESAPEAKE, OHIO & SOUTHWESTERN RAILROAD; OR, AS NOW NAMED, THE NEWPORT NEWS & MISSISSIPPI VALLEY RAILROAD: RESULTS OF GEOLOGICAL WORK DONE.

The line of this railroad, a road completed since the Civil War, lies wholly within the area of the Loess, our No. 3 of the enumeration above. The road enters Tennessee from Kentucky, striking the eastern feather edge of the formation, and runs southward through Obion, Dyer, Lauderdale, Tipton and Shelby, the tier of counties whose principal upland formation, as already stated, is the Loess.*

The road is well located. Its belt of country has great agricultural wealth and resources, to say nothing of the forests of

*While the *Loess* is the principal upland formation of this tier or belt of counties, and gives character to their surface, it must be noted that two lower formations exist within the area. These are the *Orange Sand* immediately below the *Loess*, and the *Lignitic*, at the base, next below the *Orange Sand*. These formations are concealed by the *Loess*, excepting as they outcrop occasionally in deep cuts, the banks of streams, and in the great bluffs facing the Mississippi River or its bottoms. All three are well displayed, horizontally stratified, in the precipitous face of the famous bluff overhanging the river at Randolph, a bluff rising nearly 200 feet above low water. In this, while the *Loess* and *Orange Sand* are presented in their entire thickness, the top part only of the *Lignitic* group is seen above water. This top part, however, is a large part, quite one-half, of the face of the bluff. At Randolph the country and formations are greatly elevated above even high water of the river. At certain other points there is a marked depression, as at Memphis, where the *Orange Sand* is only seen at low water, and the *Lignitic* not at all, though penetrated in boring wells, the visible bluff at good stages of the river being wholly *Loess*. Along the Chesapeake, Ohio & Southwestern Railroad the *Orange Sand* is, as we shall see, sometimes reached in the deeper cuts. I have not as yet observed the *Lignitic* in any of them.

unsurpassed timber now unfortunately, perhaps, too rapidly disappearing. This wealth and these resources are due chiefly to the fact that the mealy and earthy, and yet compact, Loess, supplies everywhere, with the subordinate yellow loam sometimes above it, one of the best and strongest upland soils in the State. Table-lands, hills and slopes all have this sub-stratum, and all speak for themselves in the abundant crops produced.

If such be the importance of this formation, one may well ask, What further is this Loess? I have already characterized it as a fine, ashen-colored or yellowish, siliceous earth. A fragment of it can be crushed between the fingers into powder, and yet in mass it is compact enough to stand when cut down, precipice-like, in a vertical face 100 feet high or more. It presents, in the words of another, a "remarkable combination of softness with great strength and stability of exposed surface." It is hardly a clay, though sometimes so called. In consistence it is more like chalk. It contains an excess of fine siliceous or the finest sandy matter, in which specks of mica are discernible. The fine granular texture of the Loess, and its consequent easy permeability to water, induces a good drainage of its soils, a drainage further facilitated by the loose, coarse sands and gravels of the Orange Sand, which, usually at low levels, immediately underlie it. And here it may be noted that the Orange Sand or Drift is useful as a drainage horizon in other regions outside of that of the Loess.

A leading characteristic of the Loess is the limy or calcareous nature, and its agricultural value depends greatly upon this. At many points it contains oddly-shaped concretions, called in Europe, where a similar formation occurs, "Loess puppets," in which the cementing material is limy matter (calcium carbonate). A curious feature is the presence often of land shells (snails) and fresh water shells in its mass, and now and then fossil bones of extinct land animals. Wells sunk into the Loess supply hard limestone water, as at Union City, Troy, Dyersburg, Ripley and other towns. At a number of points the wells have been abandoned as sources of supply for drinking water and cisterns substituted, and these, fortunately, such

is the nature and consistence of the formation, are easily constructed. An excavation is made in the earthy mass of the desired size and form, to the naked but firm walls of which, without the use of brick or stone, the proper cement is applied directly.

If at certain seasons one takes a glass of Mississippi River water, and lets the water stand awhile, there soon settles a deposit of very fine grayish material ("mud"), which, after drying, would be much like our Loess. Some think the Loess had a similar origin, or that the area of the belt in which it occurs was once covered with muddy, or turbid and rather quiet waters, and that by a continuous deposition of the muddy matter the great bed was formed. Others believe that it has been the work of the winds, the material having been drifted by them and spread over the area, in time accumulating to a great depth. So far as our Loess is concerned, the first view is by far the more probable. All the facts in the case of our Loess point that way, though we cannot discuss them here. It is enough to know that such a formation exists, and that it confronts us in a very tangible and practical way, a boon to the section in which it occurs.

It has been stated that in the tier of counties commencing with Obion and ending with Shelby, the Loess is the principal formation, and that, not regarding the local and subordinate yellow clay, it caps the wide table-lands of these counties everywhere. The formation is well seen in the precipitous bluffs from 100 to 200 feet in height, whose bases are washed by the Mississippi River. Clear vertical sections of the formations of the region are seen in these bluffs, as at Randolph and Memphis. Now, these bluffs are simply points in a nearly straight line of bluffs, all capped with Loess, that extend north and south through the State, and form the westerly-facing escarpment of the table-lands along which the latter suddenly break down and come abruptly to an end. I have called the whole line *the Bluff*. It has been formed by the encroachments of the Mississippi, the river reaching or eating at intervals of time into the table-lands and undermining them. At the present time the ever-changing Mississippi touches the line of bluffs, or

the Bluff, at only two points, Randolph and Memphis, and the exposures there are kept fresh and conspicuous by the constant washing and undermining of the river. At all other points we descend from the table-lands into the low, dark bottom of the great stream.

But the Loess, with its table-lands and line of bluffs is not confined to Tennessee. It extends northward into Kentucky and far southward into Mississippi. And further, it once spread itself westerly into the States beyond the Mississippi, from thirty to fifty miles, quite across the great bottom, and, indeed, with underlying formations filling up the latter to the level of the existing highlands on each side. Since then all within the area of the bottom has been removed by the tortuous and destructive river, leaving only on each side remnants of what once was, in Tennessee, the capping formation and the table-lands, with their bold escarpment or Bluff, and in Arkansas, the same formation and corresponding table-lands and Bluff. The bluffs are opposed, face to face across the bottom, just discernible through thirty or forty miles of clear air on a bright day.

Confining ourselves to the east side of the river, Hickman, in Kentucky, Memphis, in Tennessee, and Vicksburg, in Mississippi, are built upon the Loess. At Memphis and Vicksburg the deep cuts, with perpendicular walls, excavated in and through it for streets and railroads, present grand displays of this wonderful formation for investigation and study. It is surprising to see how it stands for months with a vertical, wall-like face, as if it were so much marble or granite. And here, in further illustration, and to show how the Loess was made available in a great emergency, I quote a passage from Gen. Grant's article on the siege of Vicksburg, in the *Century Magazine* for September, 1885:

"The ridges [broken table-land] upon which Vicksburg is built, and those back to the Big Black, are composed of a deep yellow clay [Loess] of great tenacity. When roads and streets are cut through it, perpendicular banks are left, and stand as well as if composed of stone. The magazines of the enemy were made by mining passage-ways into this clay at places where there were deep cuts. Many citizens secured places of

safety for their families by carving out rooms in the embankments. A door-way in these cases would be cut in a high bank, starting from the level of the road or street, and after mining it in a few feet, a room of the required size would be carved out, the dirt being removed by the door-way. In some instances I saw where two rooms were cut out for a single family, with a door-way in the clay wall separating them. Some of these were carpeted and furnished with considerable elaboration. In these the occupants were fully secure from the shells of the army, which were dropped into the city night and day without intermission." A lady who was in the city during the siege reported the hills as honeycombed with caves, the digging of which became a regular business. They were propped with thick posts as in a coal mine.

Loess further is found in other parts of the world outside of our own country. It is found in the banks of the Rhine in Europe. The term Loess itself is of German origin, coming from a word meaning to loosen. In Northern China it, or a formation exceedingly like it, covers several hundred thousand square miles of the surface. Here "thousands of villages are excavated in the most systematic manner at the base of the cliffs of Loess. Doors and windows pierced through the natural front give light and air to suites of rooms, which are separated by natural walls, often plastered with cement made from the Loess concretions. These are the comfortable dwellings of many millions of Chinese farmers, and correspond to the ruder 'dugouts' of Nebraska."—*Pumpelly after Richthofen.*

The Chesapeake, Ohio & Southwestern Road, when leaving Kentucky, first enters Obion County. Obion may be taken as typical of the Loess tier of counties, in which, it will be recollected, are included, besides Obion, Dyer, Lauderdale, Tipton, and Shelby. Obion is the freshest of them all, and perhaps better represents the others in their condition before the cultivation of cotton had taxed their resources so heavily. It was farther away from the center of this destructive cotton culture in slavery times; its soils, in general, have not been so overworked; old and thrown out fields are not as often met with; it had more forest to clear up for new land; its people have

been enterprising, and now the county stands in the forefront, active and prosperous. It is a wonderful area. No county in the State with such giant timber—whole houses in a single log, trees with dimensions so great that the report of them staggers belief. Beeches, great “poplars” or tulip trees, oaks, sweet and black gums, hickories, linns, elms, monster sassafrases, sycamores, hornbeams, maples, walnuts, mulberries, honey locusts, and other lime-loving trees predominate, all of the largest size, and so large that in the early occupation of this part of the State the settlers feared to attack them. Their formidable dimensions actually retarded for a time the settlement of parts of the county.* Now, however, it is different. We know better how to handle the huge trunks. They have become food for numberless greedy saw-mills, and the best of them are fast disappearing. Their days, I am sorry to say, are numbered. The walnuts are already gone, the “poplars” rapidly going, the best of the others soon to go; and then, what next? What will replace this timber for the use hereafter of the county itself?

In speaking thus of Obion, however, I do not intend to disparage the other counties. In general features they are like Obion, and are in the same category. In some respects they have the advantage. Most of them, as an example, can boast a greater area of level or favorably rolling uplands, for parts of Obion are exceedingly rough and hilly. Their worn soils have generally strong undersoils, and can be restored, and many have been. The restoration is nearly always practicable where washes and gullies have not been permitted to grow and grievously mar the surface and thus ruin the land. These counties have, too, a fair quota of new and fresh land of great and generous fertility. At any rate, take them as they are and considering their uplands alone, they will not suffer in contrast with any group of counties of the same number in the State. Their soils are based upon the Loess, and this holds all the fundamental requisites of a strong fertility.

*At the exposition held in Nashville in 1872 there was exhibited a cut twelve inches long taken from a sassafras tree felled near Union City, which measured, inside the bark, four feet and eight inches in diameter. The bark was two inches thick. The cut was taken from the trunk at a distance of twelve feet from the butt, and was perfectly solid. There are also growing in this region mammoth poplars, whose trunks, at a distance of three feet from the ground, will measure not less than seven feet in diameter.—*Resources*.

As to the washing of the lands, the people of the whole Loess belt may thank their stars that they have such a substratum for their soils. Its compact nature and stability of surface of which we have spoken does not allow of ready washing, and but little attention comparatively is needed to check such action and keep the surface intact. How different with the midland counties just to the east of the Loess belt. There the chief substratum is the Orange Sand, and when the loose sands of this are laid bare once and well started in washing, there is no telling the end of it. To this fearful washing, the many raw places, ravines and great hollow excavations, glaring with sands of many hues, white, red, orange and yellow, and seen along all the railroads from Fayette and Hardeman to Weakley and Henry, abundantly testify. They are serious wounds; if not on the body politic, most surely on mother earth. I would say on both.

In what has been said as to the soils of Obion and of its tier of counties I have had in mind the uplands, including tablelands and slopes. A word as to the bottom lands of the rivers. Many of these, when above overflow, are most superior lands, adding immensely to the agricultural wealth and products of the counties. They are in some regions the main reliance of the farmer or planter. The arable bottoms of the Obion and Forked Deer Rivers are wonderfully fertile, and a great factor in the agricultural resources of Obion and Dyer Counties, more especially in those of Dyer. One can ride for miles in the bottoms of the latter county with the most luxuriant crops growing around him, the finest cotton and corn, in which an upright horseman could effectually hide himself. These bottoms owe in good part their strength and fertility to the washings from the Loess hills and slopes which bound their valleys.

As before stated, the line of the Chesapeake, Ohio & Southwestern Railroad lies in Tennessee, within the belt of country whose chief formation is the earthy Loess, the characteristics of which have been given. Nearly all the cuts excavated for the bed of the above road, from Kentucky to Memphis, are in the Loess, and many of them give sections of special interest to geologists. (Note, page 65.) The most important are noticed below :

The first is very near *Paducah Junction*, the point at which the Chesapeake, Ohio & Southwestern Railroad is crossed by the Nashville, Chattanooga & St. Louis Railroad, in the north-eastern part of Obion County, and between three and four miles east of Union City. About a fourth of a mile west of the Junction, the Nashville, Chattanooga & St. Louis Road passes a low dividing ridge through a long cut, showing at its deepest part the following section of the formations:

1. *Soils*, resting directly on the Loess, there being no appearance of the Yellow Clay Loam.
2. *Loess*, well characterized, 6 feet thick. At the bottom, shows transition into the formation below.
3. *Orange Sand or Drift*, 6 feet exposed, mostly coarse, compact sand, a little clayey; yellowish gray with trace of red in upper part; orange below; grains of sand rounded; a few quartz pebbles of the size of peas in the lower part.

The summit passed here is the highest point on the road between the Junction and Union City. The Orange Sand appears at the bottom and middle of the cut, and, with a broadly rounded upper surface, presents itself as the longitudinal axis or core of the ridge, with the layers of Loess and soils resting like inverted troughs upon it. All the formations, with the surface of the land, dip away on both sides from the axis of the ridge. There is reason to think that before the deposition of the Loess, the Orange Sand existed here as a well-defined ridge, and that afterward on its warped surface the fine material of the superior formation was thrown down. On the other hand, this upward bending may be due to a local elevation of all the strata.

It is to be noted that the Loess here has but little thickness, pointing to the fact that the Junction is not far within the feather edge or eastern limit of the formation.

From Paducah Junction through Rives and Newbern on to Dyersburg all the railroad cuts are in the Loess, some of them exposing instructive sections. No Orange Sand was observed in any of them.

Rives is in Obion County, and has importance for the reason that at this point the Chesapeake, Ohio & Southwestern Road

is crossed by the Mobile & Ohio Road. It is a thriving business point, located just outside and west of the part of the bottom of the Obion River subject to overflow. It may be said to be in the second bottom of the river, a very fertile and level area, running back from the town nearly a mile to a line of sloping hills. These hills begin the uplands or table-lands, which extend with more or less continuity far west to the vicinity of Reelfoot Lake. They are made up of Loess, and are of easy access from Rives for observation and study.

Newbern. This active business place is on the Chesapeake, Ohio & Southwestern Railroad, in Dyer County, nearly 9 miles Northeast from Dyersburg, the county-seat. It is located in an elevated and rolling belt of country between the Obion and North Forked Deer Rivers. For ten miles in every direction around Newbern the country is rich and thickly populated. One is never out of sight of a house. It is asserted that this area produces more than any equal area in the State, the products being chiefly corn, cotton, tobacco and wheat. The uplands are based on the fine material of the Loess, and is a good example of the lands this formation gives us when the surface has a favorable topography and lies well. The railroad cuts and exposures in the vicinity of the town all show the earthy material of the Loess. The gravel and sands of the Orange Sand formation are not seen. These in the town itself are reached in digging wells at a depth of 60 or 80 feet.

From Newbern to Dyersburg the railroad excavations are made as heretofore in the prevailing formations of the country, the Loess. Approaching Dyersburg, several instructive cuts are passed through.

Dyersburg, the county-seat of Dyer, is located on the north bank of the North Forked Deer River. It is an enterprising, attractive town, built on high ground; has a commendable quota of churches, schools, mills and mercantile establishments, and is the center of a fertile and well-settled section of the county. A substantial and handsome iron bridge spans the river, connecting with a trestle and "levee" which cross the wide bottom opposite the town. In favorable stages of the river steam-boats ply between the place and the Mississippi,

thus supplying water navigation. Dyersburg is one of the points at which the Forked Deer, in its meanders through its great bottoms, strikes the uplands. The bluff thus formed is the foot of a slope which descends gradually from the highlands back of the town, and upon which the town itself is built. The superior formation is everywhere Loess. Underlying this at the lowest levels, as for example at the base of the bluff and in a deep ravine made by a branch running through the eastern portion of the town, outcrops of the sands of the Drift or Orange Sand are seen. The formation rises as we go back from the river. At the base of the bluff the outcrop shows a thickness of six feet from the low water line up. Ascending the ravine, a half or three fourths of a mile from the river, a bold and characteristic outcrop of the Drift is exposed. It is here twenty feet thick, and the sands are largely dug into and used for building purposes. It is known as the sand-bank. The section is as follows:

1. *Loess*, at top, from 40 to 50 feet thick.

2. *Orange Sand, Drift*.

(a.) Sand, orange colored, with some clay, often in a compact, hard layer, six feet.

(b.) Loose Orange Sand with white sand in irregular vein-like masses and pockets, resting on deep yellow sand, eight feet.

(c.) Part not exposed, down to branch, five feet.

No gravel is seen in this bank, but about one hundred yards below, on the same branch and just above it, is a conspicuous bed of gravel mixed with sand, which is eight feet thick. The junction of the two formations, the Loess and the Drift, can be satisfactorily studied in this ravine.

The position of the underlying Orange Sand at Dyersburg ought to establish a good under-surface drainage for the town. Water and sewage sinking through the more or less pervious Loess, are received by the sands and carried off at their outcrops; and, on the other hand, for this very reason, the springs which issue from this horizon of sands ought to be guarded, or they may become contaminated and rendered unfit for drink-

ing purposes, especially if the water they discharge comes from under a thickly populated portion of the town. Many of the citizens use cistern water, mostly, however, I believe, because wells in the Loess supply hard water.

From Dyersburg to Ripley, the county-seat of Lauderdale, the bed of the railroad, outside of the bottoms, lies all the way—with the exception of a single break—on the earthy Loess. So it appears, at least, to one traveling the road. Cut after cut displays the yellowish gray and ashen material of this formation. The exception occurs at a saw-mill station six miles north of Ripley, named “Curve”—so named because the road, immediately south of the station, makes a noted curve in passing through a prominent ridge. This ridge is the “divide” between the waters of South Forked Deer River and Cane Creek. The curve lies in a deep cut, in which the formations are well exhibited. Conspicuous in the lower part is the Orange Sand, showing here much gravel mixed with sands. Pebbles of unusual size, some as large as goose-eggs and larger, are seen. Resting on this is the horizontal bed of Loess, rising up in threatening walls above one’s head. The formations are first observed back at the station, before entering the cut.

Ripley, the county-seat of Lauderdale, a prosperous town, noted for its higher educational advantages and the intelligence of its people, is “a city set upon a hill.” Built upon an elevated ridge, or high belt of table-land, the watershed between Cane Creek on the north and Hatchie River on the south, it can, of all the towns in Tennessee along the Chesapeake, Ohio & Southwestern Road, boast the greatest altitude and doubtless the purest air. On the east side of the town the belt of table-land on which it is contracts to a narrow neck or ridge. through this the railroad passes in a fearful excavation or cut fifty feet deep, and with nearly perpendicular walls. From the level of the higher and more removed portions of the town it is sixty and seventy feet to the bed of the road. A bridge high in air spans the chasm, allowing ingress and egress for the population, without fear of accidents from moving trains.*

* This bridge, as I was informed, is one hundred and thirty feet above Batle’s Creek, a tributary of Hatchie River, and crossed by the railroad a mile and a fourth to the south.

The two formations—the Loess and the Orange Sand—are grandly exposed in the great walls of the cut. The locality is one of special interest, and traveling geologists will find it a good point for the study of these quaternary formations. The section in the deepest part of the cut, under and just north of the bridge, is as follows:

1. *Soils and Loess*, in the slopes from the higher level to the bridge ----- 10 feet.
2. *Loess*, well characterized from the bridge down ----- 20 feet.
3. *Loess*, a shade darker than above; its lower part containing gravel and, sparsely, glassy grains of sand, passing into the division below*----- 8 feet.
4. *Orange Sand or Drift*, chiefly loose sands of orange and yellow colors, rarely white; with occasionally in places white pipe-clay, mainly in papery more or less horizontal seams, down to the road-bed ----- 20 feet.

The strata of the belt of highlands upon which Ripley is situated have been elevated, have been elevated in a great upward flexure or wave, with its length lying approximately in an east and west direction, or transversely to the line of the railroad. In their present condition the strata may be compared to a series of shallow and inverted troughs lying in order one above another. To this remarkable upward flexure the exceptional elevation of the highland may be due. The railroad crosses this flexure, exposing in the deep cut the structure of the ridge. The road, after leaving the valley of Cane Creek, in approaching Ripley one mile to the south, ascends with a heavy grade, passes the summit in the cut, and then descends as rapidly, a mile and a fourth, to Batie's Creek. The strata of the formations have also their highest elevation in the cut, and descend (or dip) each way, north and south, even more rapidly than the

* The lower part of this division, containing gravel, might have been included as well in division 4. The horizon is a transition one, partaking both of the character of the Loess and the Drift. It may be mentioned here that the cherty pebbles found in the cut are often fossiliferous, the fossils being chiefly carboniferous; many, too, are oolitic in structure. While most of the sands in the cut are loose, yet, at the north or east end, the upper part of division 4 becomes a layer, with a maximum thickness of ten or twelve feet, of compact brownish-red sand, quite hard and resisting to a considerable extent the action of water. This is underlaid by loose sand, and for this reason is easily undermined, causing it to fall in blocks often large and massive. At the south end of the cut, division 4 has at its top thin layers or crusts of dark and reddish ferruginous sandstone. Such sandstone, in other places, about Ripley, is sometimes thick enough to be used in constructing the foundations of buildings. The geological horizon shown in the cut is a proper one in which at other points to look for serviceable rock.

railroad. So rapidly, indeed, that within less than half a mile from the summit on each side, the Orange Sand has sunk out of sight, and the Loess, notwithstanding the lower elevation, is the only formation seen along the track.

The uplift at Ripley has involved an elevation of the strata of not much, if any, less than 100 feet. There has been perhaps a similar elevation at Curve, the formations of which have been noticed above. It must be stated, however, that the elevation in both cases may be accounted for differently. It is possible that, before the deposition of the Loess, the materials of the Orange Sand, for some reason, was heaped up in ridges, and that upon these the Loess was quietly and continuously deposited. An argument for this view may be drawn from the fact that unusually large pebbles or bowlders occur in the Orange Sand along these axes of elevation.* These uplifts have probably had something to do with the general drainage of the country and the location of the valleys.

The degree of elevation of the formations at Ripley and Curve make it probable that near these places, in the range of the flexures, at low and favorable points, the dark, shaly clays of the underlying Lignitic group may be brought up and be seen if looked for.

I have referred above to the high position of Ripley and the quality of its air. In connection with this I add that here, as in other towns built upon the Loess, the wells supply hard water, the cause of which has been stated. These wells, used formerly by the citizens of Ripley, have been, as elsewhere, to a great extent abandoned and cisterns substituted, with the effect of a manifest improvement in the health of the place. Sewage and surface drainage, it is suspected, may have had something to do with the character of the well water raised from the pervious Loess. Calcareous, or limestone water, is used in many parts of the State with perfect impunity, and in itself is not necessarily hurtful.

About a mile and a half east of Ripley, in a great wash by the side of the road, a layer of bright yellow ochre, of good

* Compare what is said as to the position of the strata in the cut on the Nashville & Chattanooga Road near Paducah Junction (p. 72).

quality, occurs, which for some time past has attracted attention. The ridge or belt of highlands upon which Ripley is built, extends off eastward beyond the railroad. The road (Brownsville road) leading to the ochre locality is upon this ridge. The wash is a great hollow excavation made in the side of the ridge by the washing out of sand and the consequent undermining and removal of the Loess. The formations are much the same as in the big cut at Ripley, the Loess above and the Orange Sand below. The latter shows much loose sand and some of the brownish red compact kind. A noteworthy feature is the presence in the sands of large pebbles and rock masses as large as ostrich eggs or a peck measure. They contain, also, thin layers and crusts of ferruginous sandstone or sand rock. It is immediately under one of these crusts, a sloping crust running to the very bottom of the exposure, that the ochre occurs. No considerable thickness of the ochre could be seen at the time of my visit. I was informed that a boring had been made at one point, which proved that the thickness of the bed there was fully three feet. Further explorations, however, will have to be made before a decided opinion can be given as to the extent of the deposit. It is to be determined whether a sufficient quantity exists to make the mining of it an object.

The better qualities of ochre are sold at from \$15 to \$30 per ton, the latter price for finely-powdered ochre, barreled and delivered in New York.—*Mineral Resources, Williams, 1883-4.*

From Ripley to Memphis no special examinations were made along the line of the railroad. This part of the work is unfinished and reserved for another season. I add, however, a few notes made after a preliminary survey.

With a few exceptions, the excavations along the Chesapeake, Ohio & Southwestern Railroad, from Ripley to Memphis, are made in the Loess. Its earthy mass appears in all the cuts, while in but very few is the Orange Sand, with its parti-colored sands and gravel, to be seen underlying it. The latter is the case in some cuts just north of Kerrville, twenty miles from Memphis; as the road going south descends from higher ground to Kerrville in the valley of a branch it cuts down through

the Loess and into the Orange Sand. At Memphis, as stated in the note on page 65, the sands and gravel are only seen at low water, the conspicuous bluffs being simply cliffs of the Loess silt.

From Ripley southward the aspect of the country betrays the Loess. Many sections are gently rolling table-lands, so lying as to be choice agricultural areas. This was early discovered, and many of them were pushed to their utmost in the making of cotton. The old fields here and there testify to this. The Loess formation supplies, however, a good basis for recuperation where the lands are not too badly washed. In some sections progress has been made in this recuperation. It is noted that, at the first the uplands were by preference cleared up and put in cultivation. These were the more healthful, the more easily deprived of their forests, and their soils more mellow and tractable. Now, however, the great timber is removed with profit, the clearings have passed into the second bottoms of the streams, and as far into the first bottoms as the overflows will allow. And in the bottoms the soils are black, highly productive and lasting.

Covington, the county-seat of Tipton, is on the Chesapeake, Ohio & Southwestern Road, about a third of the way from Ripley to Memphis. It is in the midst of a nearly level or gently undulating country, the latter quite in contrast with the hilly area around Ripley. The region about Covington is a rich and desirable agricultural one. The town is pleasantly situated on a low, flat-topped ridge or table. Its geology is simple. The washes on the slopes are not deep. Those existing show the Loess to be the underlying formation. The materials of the Orange Sand were not seen outcropping at any point, though they may do so at points not observed. I was informed that in digging wells sands are often reached. A noted spring breaks out at the foot of the ridge or table at the north side of the town. It flows freely, and supplies apparently good water. The existence of this spring makes it probable that the Orange Sand formation is not far off, and that it may underlie the surface in places at the lower levels. Though having no direct reason for doubting the wholesomeness of this

water, yet as it is apparently the discharge of a stream coming out from under the town, the sanitary officer has need to look after its purity. If not now, it may become contaminated by the infiltration of sewage and drainage from the surface through the earthy and porous Loess.

A traveler from the East cannot fail to notice the wide bottoms of the larger streams crossed by the Chesapeake, Ohio & Southwestern Railroad in West Tennessee. They are a marked feature, and one to interest a stranger unaccustomed to them. The road passes them on embankments or trestle-works often more than a mile in length. They are low, damp and dark, with heavy timber. Large parts of them are swamps, in which unique cypress trees abound, or have abounded; and on areas deprived of the best of the trees the stumps still stand, having about them the twisted, gnarly individuals left by the axmen. Springing from the roots are, further, the curious cypress knees, thrusting themselves up from the wet ground thickly around the mother trees, as if so many horns from nearly buried heads of rhinoceroses or unicorns, to keep away intruders.

Another feature of the road is the great number of saw-mills and lumber depots dotted along its course. The great timber resources of this Obion-Shelby tier of counties, of which we have spoken, explains the existence of these. The road is comparatively new, especially its more northern part, and the forest areas have been but little encroached upon. Now it is different. The slaughtering is well under way, and is going on in earnest. Soon the best of the timber will be gone, not to be restored in the day of our children, if ever.

SUPPOSED STONE-COAL IN OBIION COUNTY; A VISIT TO THE LOCALITY AND NOTES BY THE WAY.

During the last spring and summer various reports came to the authorities at the Capitol in regard to an alleged discovery of stone-coal in the southwestern part of Obion County, near the line of Lake County. The locality is in the bottom of the Mississippi River, near the foot or "scatters" of Reelfoot Lake.

The parties concerned were urgent that an official examination be made, and it was thought best, though the high improbability, to put it mildly, of finding stone-coal in such a position was patent to us all, that I should visit the place. The visit was agreed upon the more readily as thereby, outside of the alleged discovery, other desired points of information could be secured. In accordance, therefore, with previous arrangement, I met Mr. T. P. Callicott at Rives, who kindly conveyed me to his saw-mills, located near the region of the supposed discovery. These mills are about eighteen miles, air-line, southwest from Troy, the same distance a little north of west from Dyersburg, three miles from Obion River, and eight miles from the Mississippi. They are situated at the foot of the heavily timbered ridges, making the extreme point of the highlands between the bottoms respectively of the two rivers mentioned.

The formation of the ridges about the mills is Loess from base to top. The Orange Sand does not appear. In the bottoms of running branches one meets with beds of the curious limy concretions known as "Loess puppets," but with no true gravel. The fact is, that in this region the formations are much depressed, the Orange Sand not appearing even at the lowest levels.

Around the point of highlands made by the ridges, there sweeps, in more than half a circle, a vast expanse of flat, weird, darkly timbered bottom, illimitable to the west in the direction of the Mississippi, and only bounded in the south by the dim outline of another point of highlands. To the northwest a few miles away is Reelfoot Lake, scarcely seen through the trees; to the south is Obion River, completely hidden by them. The bottom is all, less the lakes and streams, deep alluvium; surely a forbidding horizon in which to look for stone-coal. Most responsible for originating the idea of stone-coal here were the presence and finding of flattish pieces of *lignite*, pebble-like, with worn or rounded edges, of all sizes from one inch to four inches across, and of variable thicknesses. To an untrained eye they do, indeed, look like stone-coal, but a proper examination soon brings out their true nature. They are brown, not black. When split they betray, especially under a

moderate magnifier, a woody structure, often appearing like overbaked and browned wood. These lignite pebbles, as we may call them, are found scattered through the area of the bottom, but most abundantly along or near the bayous. A party of us explored one of these bayous, an outlet of Reelfoot Lake, five or six miles from the foot of the highlands, and deeply within the bottom of the Mississippi. We found many of the lignite pebbles along its course, both in its bed and on the banks. We had also found them along the roads winding through the bottom and away from the bayous. After the nature of the pebbles had been made out and they had proved to be lignite, all expectations of finding stone-coal vanished into thin air. The observations made, however, had the effect to create no little interest as to the source of the lignite. Whence came the lignite pebbles, sown so broadcast over the surface? This question raised, we set about to solve it.

It was known that the bottom is pretty thickly spotted with low mounds of yellow and sometimes white sand, and of varying dimensions, from 3 and 4 feet in diameter to 10 and 20, and often containing great volumes of sand. Many of these are crossed or otherwise disturbed by the roads, for which, indeed, they often make good bedding. They are known by the significant name of "sand-blows." There can be no doubt as to their origin. They are one of the results of the great earthquakes of 1811-12, which so fearfully disturbed the foundations of this whole region, a disturbance far greater than that which, within the last few months, came so near destroying the fair city of Charleston. The effects of these earthquakes are especially manifest in Obion, Lake, Dyer and Lauderdale Counties, both in the bottoms and on the highlands. The chasms made then on the highlands are now partially filled up, but enough of their number and greatness is seen this day to strike the observer, who winds his way for the first time among them, with amazement and a feeling akin to terror. Confining ourselves to the area of the great bottom in hand, the throes of the earth coming thick and fast rent the surface into numberless fissures of unknown depths, from points of which there spouted up furiously streams of water and sand, the latter falling in piles, like ashes and debris around

a volcano. The piles of sand thus made are the "sand-blows," so-called, of to-day, a name conventionally meaning piles or heaps of sand, but implying as well their mode of origin. Now, the sand-blows are low mounds,* and further, are covered with a cap of mud from 4 to 8 inches thick, the result of the successive depositions of sediment from the high-water overflows of the Mississippi River for 75 years.

From certain indications, we were led to suspect that the lignite pebbles had something to do with the sand-blows. We began to dig in them, and sure enough we found the lignitic masses plentifully mixed and buried in the sand. We dug into many of the mounds, and to various depths, and always with like results. Our question was answered at least as to one phase of it. The lignite pebbles had been thrown up with the sand and spouting water from some source below. The movement and the attrition of the sand and water were cause enough to account for the rounded edges and pebble-like forms of the lignite. The washing down of the sand-blows by currents, and the consequent exposure and drifting of the lignite, accounted for its appearance on the surface as well as for its more abundant occurrence along the bayous.

It remains to explain from what source below the bottom the lignite is derived. We have said that in the highlands about Callicott's Mills the only formation in sight is the earthy Loess. Could we bore down at this point, we would find that next below the Loess, come in order the Orange Sand formation, less than 100 feet in thickness, and then the Lignitic Group of unknown thickness, possibly 1,000 feet or more.† The latter contains beds of lignite. Both formations extend under the alluvium of the bottoms. In the earthquake disturbances the rents and displacements extended to the deepest strata, fracturing with the others the lignitic beds, and at points crushing them into fragments. The ascending waters seized these fragments and brought those compact enough to resist the wear and tear, with

* In the great bottom a mound a foot or two above the general level is considered quite a hill, and a line of surface which manages to keep its top above the moderate overflows, is a big ridge, dignified with a special name, as Hickory Ridge, White-oak Ridge, etc.

† For descriptions of these formations see page 62.

the sands of the formations, to the surface. Such is the source and the history of the lignitic pebbles. Their rounded edges and angles show the rough usage to which they had been subjected in their forced ascent.

Going north from Callicott's Mills, along the line of bluffs facing Reelfoot Lake, the three formations above mentioned become much elevated, and at many points, especially as we approach the Kentucky line, are well exposed and may be conveniently studied. The same elevation is seen at Fulton, in Lauderdale County, and at Randolph, in Tipton. At Randolph the section is a grand one and very instructive. (See page 65.) At Fulton a bed of lignite outcrops in the bluff. Many years ago, before the war, this bed was examined by self-constituted experts, who pronounced it true stone-coal, or the outcroppings of stone-coal. The property was purchased, buildings erected and much money spent. They were going to supply the Mississippi Valley with coal. After due time the miners discovered their mistake, their works were abandoned and the enterprise came to an inglorious end.

The ridges about Callicott's Mills are terribly shattered by the earthquakes of 1811-12. All are shattered. The fissures are numerous. In some places belts of land, a few feet to fifty feet wide, have sunk bodily down four to six feet. The fissures often extend lengthwise with the summits of the ridges, but sometimes run across. They appear to have, so far as the points of the compass are concerned, no determinate direction. These effects extend for miles. It would appear as if the forces had produced their greatest results in the fringing ridges terminating the table-lands of the county, and in those especially pointing to the great bottoms.

This region is subject even now to slight earthquake shocks. I was at the mills the 15th of July, 1886. Up to that time there had been three distinct shocks since the first of the year. One occurred some days before my visit, and so alarmed the lady at whose house I was entertained, and who had not been in the region long, that she was half disposed to move away.

The older inhabitants, however, take them as a matter of course, and speak of the "shakes" with unconcern.

My route to and from Callicott's Mills took me through Troy, the county-seat of Obion. Troy has a pleasing location on high ground. The formation underlying it is Loess, and the cuts about the place afford good opportunities for the study of the characteristics of this earthy and remarkable deposit. (Page 62.) The gravel and sand of the Drift or Orange Sand formation, which lie next below the Loess, were not seen in the lowest places on the branches, though their horizon must be nearly reached. On the road to Union City, at a point within two miles of Troy, a small stream flowing between high hills has cut its way down through the Loess into the gravel and sand, and, indeed, through these to the top of the Lignitic Group. At no other point on the Union City road has this occurred, so far as I have seen. The formation is Loess all the way. The high hills just referred to are very steep, and present the formation in great force.

One mile from Troy on the Dyersburg road, immediately after crossing Mill Creek, one ascends a formidable hill known as Faulk's Hill. On this there is a wonderful presentation of the Drift gravel. It is the bed of the road from the creek to nearly the top of the hill. The presence of this gravel appears to be due to a great uplift of the formations, resulting from a faulting and displacement of the strata, though the comparatively enormous volume of gravel may point to a different explanation. How it has occurred is a problem to be solved. But be this as it may, the quantity of the material exposed is truly extraordinary. The property is owned by Mr. Joel Faulks. He informs me that the gravel is seen up the creek for three-fourths of a mile. At some points the pebbles have been cemented together with iron ore into blocks of a sort of iron conglomerate. This bed of gravel may some day be utilized to great advantage. It would be a boon to a railroad for ballasting purposes. Troy, with this at hand, might have the best of streets at all seasons. In the region of the gravel on Mr. Faulk's place are also beds of tough plastic clay, which are worthy of attention, and may prove extensive and valuable.

PROGRESS OF THE SURVEY ALONG THE LOUISVILLE & NASHVILLE
RAILROAD, MEMPHIS BRANCH.

Reference here is to the part of the road from Big Sandy Station to Memphis, or that part west of the Old Shore line. (Page 60.) Work on this is well advanced. A few points remain to be examined before a complete report can be presented. The line of the railroad runs diagonally across all the newer formations of West Tennessee, with the exception of the two lowest and oldest, which are confined to southeastern counties not intersected by the road. In advance of the more complete report, the following notes may be of interest to tourists, students of Geology, and to those practically concerned in the resources of the country:

Big Sandy Station, or Big Sandy River, a few hundred yards west of the Station and the boundary between Benton and Henry Counties, marks the intersection of the railroad with the Old Shore line, and has, therefore, special interest for a geologist. Along a stream on the north side of the station are good exposures of Upper Silurian Cherts abounding in fossils. On the south side of town, in lots on a slope of a hill and penetrated in digging wells, are shaly clays of the Ripley Group. These rest upon the Silurian Cherts. The sand and gravel of the Drift is everywhere the topmost formation of the hills.

On Rushing's Creek, at J. H. Hudson's place, five miles from the station, on the lower Camden road, is a section of strata which will repay the geologist visiting it. It exhibits satisfactorily the junction of the older and the newer formations. Below is Lower Helderberg limestone, with shale and heavy clay, all containing fossils. Upon this rests three feet of lignite and lignitic wood mixed with cherty gravel, and above this laminated clay. The hills along the road are capped with the materials of the Orange Sand.

Paris, the county-seat of Henry. Around this elevated and airy town, the home of many distinguished Tennesseans, are bold exposures of two important formations. The town is built upon a plateau of Orange Sand, and many grand sections of this formation can be studied in the great washes about the

place. On a high point just outside of Paris can be seen the red sandstone of the formation, and at other points beds of its gravel. Paris has further a number of potteries in which the white clays, obtained from local deposits in the Orange Sand, worked into wares and otherwise, are utilized.

From beneath the sands, on the railroad and on the east side of the town, are good outcrops of the Flatwoods Clay; and two miles to the southeast, on the Reynoldsburg road, is a naked hill of this formation. There is no better locality for the study of the two formations mentioned than Paris and its vicinity.

It is here that the railroad ascends from low lands to the high belt of country which divides the waters of the Tennessee from those of the Mississippi ("Tennessee Ridge,") the high belt being really the beginning or margin of a wide table-land that slopes gradually westward until abruptly terminating in the line of bluffs facing and overlooking the bottoms of the great river.

McKenzie, in the northeastern corner of Carroll County, and the crossing of the Nashville, Chattanooga & St. Louis Railway, is on high ground. The underlying formation is everywhere the Orange Sand, upon which, however, rests as a capping a few feet of the Yellow Clay Loam. (Page 62). Very instructive sections of the Orange Sand are seen in all the railroad cuts near this place, the best being on the Memphis road a short distance from the depot.

McKenzie to Brownsville. Details as to points along this section will appear in due time. The cuts and washes exhibit, many of them in a remarkable and striking way, the orange, yellow and white sands of the Drift. Its local beds of white potter's and pipe clay are occasionally seen. But little gravel occurs through the whole distance. Over the sands lie very generally the Yellow Clay Loam, the basis of the soils of the country. Milan and Gadsden are good points for study. The best of the exposures are seen as the road rises and descends over the higher belts of country between the ridges.

Brownsville to Memphis. Here also I speak in general terms. Soon after leaving Brownsville the aspect of the formations change. The sands are no longer dominant. A grayish or yellowish, ashen-colored earth, the Loess, takes their place and gives character to the banks and exposures along the road. The sands of the Drift, now containing more or less gravel, are only seen at low points, and, as distance is made towards Memphis, disappear altogether. In the river bluffs at Memphis we have a presentation of the Loess in force. The sands and gravel deeply underlie this formation, and are only exposed at low water of the Mississippi.

PROGRESS OF GEOLOGICAL WORK ALONG THE NASHVILLE, CHATTANOOGA & ST. LOUIS RAILROAD, WEST OF THE OLD SHORE LINE.

The following brief notes will suffice to indicate the nature and progress of the work along this railroad from Camden, on the Old Shore Line,* to Hickman, on the Mississippi River. In this course the road crosses almost directly all the newer formations of the northern counties of West Tennessee, and presents a series of localities easily reached and unsurpassed in geological interest. I am not ready for a full presentation of all that may be seen along the route. I can only mention a few of the more typical localities.

Camden, the county-seat of Benton, is situated high and dry upon a ridge of flint. The flint—or chert, as the geologist calls it—is horizontally stratified, contains fossils, and is of Upper Silurian age. The ridge might have been a sort of head-land, its foot washed by the waves when all was sea to the west of it.

On the west side of the town, on the Huntingdon road, the rocky ridge slopes down like a veritable shore, the beveled flinty mass soon disappearing under the laminated clays of the Ripley Group. The ancient flints are overlapped by the younger laminated clays. Here, then, distinctly recognized, is a point in the line of the Old Shore.

* See page 60.

The railroad lies to the south of the Huntingdon road, and crosses the Old Shore line at a bridge half a mile west of the depot. The junction of the older and newer formations is plainly and satisfactorily seen here, supplying another point in the line of the Old Shore, and quite as suggestive as the other.

Standing as at Camden, on the rocky side of this junction, the ancient rocky shore, and going back to the time when the waves rolled against it, one can easily recall the sea spreading out widely to the west, the north and the south, lying level, homogeneous, limitless,* very different from the rugged, wooded ridges now actually rising before him.

Camden and Hollow Rock, ten miles apart. Between these points the road crosses a high belt of country and then the bottom of Big Sandy River. The belt divides the waters of the Big Sandy from those of the Tennessee. The excavations made in it by the road give us many instructive sections of the laminated materials of the Ripley Group, dark, filmy sands and clays, the sands predominating.

Hollow Rock is so named from an isolated, massive rock of sandstone, large as a good sized cabin, pierced with a hole, through which a man may force himself. The rock stands by the side of the road half a mile or more east of the depot. It is on the north side, and easily seen from a passing train. It is a good example of the sandstones of the Orange Sand or Drift formation. Near this point orange-colored sand is largely dug and transported to Nashville for plastering purposes. The vicinity of Hollow Rock contributes good exposures for the study of the Drift.

Hollow Rock and Huntingdon, ten miles apart. Two miles west of Hollow Rock the road begins to surmount another dividing ridge that lies between the waters of the Tennessee and Mississippi Rivers. The cuts in the ridge show in the aggregate a heavy mass of laminated material of the Ripley Group, chiefly sand, and in some places is interstratified with clayey leaves.

* And, we might add, shipless, for not a man existed to steer a craft and navigate the wide expanse.

Huntingdon, the county-seat of Carroll, is a clear field for the study of the Flatwoods Clay (Page 68). The town is built upon it. The county roads leading out of the town to Camden, Paris, Purdy and Trenton display it well in chalky-looking exposures easily reached. The railroad, in approaching and passing through the town, crosses the belt of its outcrop for a distance of more than three miles. The hills in the vicinity are generally capped with the Orange Sands, and some of them with the brown sandstone of the Drift. In addition to the formations, the chalybeate waters around Huntingdon are noteworthy.

McKenzie, twelve miles northwest from Huntingdon, is at the crossing of the Memphis Branch of the Louisville & Nashville Railroad. Here our road has reached high plateau ground, the basis of which is the Orange Sand or Drift formation. The region is in a measure a type of the numerous and extended table-lands which prevail throughout the midland counties of West Tennessee, and which add so much to the agricultural wealth of this part of the State. The cuts on the railroads in all directions from McKenzie are characteristic and instructive, that in the direction of Memphis, half a mile from the depot, especially so. The Drift is well displayed in banks, eight, ten and more feet deep. Above it and immediately underlying the soil is the capping of the Yellow Clay Loam (page 62), from three to eight feet thick.

Dresden, the county-seat of Weakley, is, like McKenzie, on the Orange Sand as the principal formation. Many exposures of the yellow, orange, and sometimes white, sands are seen at intervals along the road from McKenzie to Dresden, and indeed, beyond to Ralston, a total distance of twenty miles. The country passed is often hilly, the washes frequently deep, and glaring with the bright and many-colored sands.

Paducah Junction, the crossing of the Chesapeake, Ohio and Southwestern Railroad, and within four miles of Union City. We are now in a region in which the aspect of the formations and country has changed. The sands of the Drift are no longer

dominant, in fact are rarely seen. The basis of the whole country is the earthy Loess. (Page 62). Half a mile beyond the crossing the road passes a ridge through an instructive cut, showing immediately below the soil a stratum of Loess six feet thick, and resting upon a core of the sands of the Drift. The core is confined to the deepest part and center of the cut, while the Loess arches over it, and makes the great part of the length of the cut.

We are now within the margin of a formation, the Loess, which is the superior formation over the whole of the upland portion of the productive belt of the State, including Obion, Dyer, Lauderdale, Tipton and Shelby Counties.

Union City, in Obion County, the crossing of the Mobile & Ohio Road, has about it the characteristic lands of the Loess. The formation is everywhere penetrated in digging wells, the sands and gravel of the Drift being sometimes reached. From this point to Troy, and out as far as the bluffs facing Reelfoot Lake, the formation is Loess, supplying extensive tracts of the best of lands.

Hickman, the terminus of the road on the Mississippi River, is beyond the Tennessee line in Kentucky. It is seated on one of the few high bluffs in Tennessee and Kentucky, washed by the Mississippi at their base. It is a classic spot for geologists. The structure of the country here is deeply dissected and exposed by the great river. In the face of the bluff one sees next below the soils, the edge of the light, ashen-colored Loess in a heavy stratum. Right under this follows the bed of the Drift materials, gravel, sands and clays, while at the base layers belonging to the Lignitic Group may be discovered. Any one visiting this spot, geologist or not, will be repaid, aside from the display of formations, in the grand view of the vast, somber bottom and its seething, rolling river.

Notes on the Mobile & Ohio Railroad, indicating the progress and character of the geological work done along this road will be found in an appendix at the end of the volume.

MINES AND MINERALS IN DEKALB AND WILSON COUNTIES.

During the last summer many citizens of parts of Cannon, DeKalb, Smith and Wilson Counties became much interested, and even excited, over the alleged discovery of veins containing ores yielding silver and gold in promising quantities. The excitement originated in the assertions of certain persons who, hailing from the mining regions of the Northwest, claimed to be mining and mineralogical experts. They "assayed" the ores and found enough "silver and gold" to set the country wild. It was enough that men calling themselves "practical miners" from the Eldorados of the West, had said so. At once the hilly regions of these counties became filled with metallic veins and precious ores. All mineral things, black and white, gray and mottled, must be, especially if unfamiliar, silver or gold ores.

At the request of the Governor and the Commissioner of Agriculture, Statistics and Mines, and also of several intelligent gentlemen of Woodbury, who desired to know the truth of the matter, I visited the two principal localities of the alleged discoveries, where work was being done or had been done. The first visited, called the Frazier mine, is on Dry Creek, in DeKalb County, seven miles by the traveled road from Liberty, and nearly southeast from that town. The second is in the eastern part of Wilson County, seventeen miles from Murfreesboro and three miles from Milton, on the Milton and Lebanon road. This is known as the Ewing mine and is located at the headwaters of Bradley's Creek.

FIRST—THE FRAZIER MINE ON DRY CREEK.

Let me state, first, that Dry Creek heads to the north, and northeast of the region of the Short Mountains, in the rugged ridges which fringe the Highland Rim, and runs west of north, emptying into Smith's Fork, three miles above Liberty.* The

*In going to the Frazier Mine, I descended into the valley of Dry Creek from the direction of the Short Mountains, and in traveling through the wild and broken country around the head of the valley, I was surprised to meet up with such a forest of yellow pines as exists there. The numerous high and flinty ridges are clothed with pines of good size and apparently but little touched. It is one of the best pine regions of Middle Tennessee. My route led me through it for several miles.

valley, which is from seven to eight miles long and a good agricultural area, is bounded on each side by high hills, but widens as it approaches the valley of Smith's Fork. Around the head of the valley the ridges are capped off with the horizontally stratified, yellowish and grayish flinty rocks (Subcarboniferous), which everywhere in DeKalb and Cannon make up, so characteristically, the high edges of the flat highlands of the eastern parts of these counties. These make the most elevated and the uppermost formation of the region. Immediately underlying this follows the remarkable Black Shale, a formation wonderfully persistent in Middle Tennessee, and always to be found wherever its proper geological horizon occurs, though hardly ever reaching a thickness of fifty feet.* Going down the valley, the bounding hills and ridges on each side lose more and more of these cap formations, until they show nothing but limestone at their tops. In the region of the Frazier mine the highest points and summits show the flint with its underlying Black Shale, but the lower ridges and the points of ridges are limestone from top to bottom. The mine is in one of the lower ridges, or, rather, on the point of a ridge lying on the south-west side of the valley. The rocks or formations exposed in a cross-section of the ridges and valleys are horizontally stratified, and are in descending order, as follows:

1. *The Flinty Strata*, already spoken of, capping the highest summits back from the valley, of variable thickness, from a few feet to 100.
2. *Black Shale*, not far from 40 feet.
3. *Blue Limestone*, the Nashville formation of the Tennessee survey (upper part of the Trenton period), having a thickness of from 400 to 500 feet.
4. *Lighter Blue Limestone*, the Lebanon formation of the Tennessee Survey (lower part of the Trenton period), its rocks just appearing in the bed of the creek.

*This Black Shale is the "*ignis fatuus*" of so-called "practical coal miners." Coming into this country wholly ignorant of its geology, or, for that matter, of the geology of any country, they "know it to be a sure indication of stone-coal," and the fact that it flames up a little when thrown on a fire, as a brickbat wet with petroleum oil would, makes them the more confident. It is no more an indication of stone-coal than the brickbat. Not a few have been misled by these wise-acres, and have had their pockets lightened by heeding their teachings. Many empty, profitless holes and drifts dug into this same Black Shale in Tennessee strongly testify to the truth of these statements.

The ridge on which the mine is located is wholly made up of the Blue Limestone Division, No. 8, and its strata are the same as those seen about Nashville. The mine is located on what we may call provisionally a fissure vein, or belt of veins cutting across the ridge, which is narrow and steep, in a northeasterly and southwesterly direction. Along the belt the strata, so far as could be made out from the shallow openings, have been irregularly ruptured into nearly parallel and vertical fissures, the number varying from one to three at different points. The latter sometimes run together, or a smaller one into a larger or main one. In places they are pinched out and their continuity broken.

Several openings had been made along the line of the belt—one a shaft just below the top of the ridge, on the northeast side, and others on the southwest slope. A little way below the shaft on the northeast side is a bold outcrop of the vein from four to five feet thick. It is a nearly vertical mass of whitish barite and glassy fluorite much mixed, and containing some calcite and a little galena. The latter occurs in small lumps sprinkled through the mixture, or in laminae forming darker streaks through the gangue material. The shaft had been sunk twenty-five or thirty feet down on the vein. The whitish vein mixture, like that above, was from three to four feet thick to begin with, but was pinched in descending to one-half the thickness, either by a limestone horse or by the approach of the walls. Crossing to the southwest side of the ridge and descending the slope a number of natural outcrops of the vein matter were met with. Several excavations had been made, and masses of gangue obtained from one to two feet and more in thickness, with more galena than was found in the shaft. The vein has been traced across the valley to the northeast for some distance, and also in the other direction to the southwest.

So far the developments made at this place are not promising. It was considered by some to be a veritable "silver mine," the ores also yielding gold; but the assays of such ores as I collected and as came into my hands contained no silver, or but the merest trace, much less gold.* The "practical miners"

* These assays were made in the laboratory of Vanderbilt University by Prof. A. C. Campbell, my assistant, and by myself.

appear to forget, or not to know, that this country is a different one from the mining silver-lead regions of the Northwest. The analogies they pretend to make out are wholly fallacious. There is a possibility that a body of lead ore, as such, might be found by penetrating the veins, but even this is very problematical and a matter of experiment. So far there is little promise of it. The vein is interesting to a mineralogist as a locality of the minerals barite, fluorite and galena. The first two occur in large quantity, and may, though much mixed, prove to be of some commercial value.

It is estimated by Mr. Albert Williams, Jr., ("Mineral Resources," 1883-4, published by the United States Geological Survey,) that in 1884 there were produced in the United States 25,000 tons of barite. The crude barite ranged from \$1.50 to \$5 per ton at the mines, varying with the quality and proximity to market.

SECOND—THE EWING MINE IN WILSON.

As already stated, this "mine" is located at the headwaters of Bradley's Creek. The region around it may be called a cove, there being a considerable area of farming lands surrounded by a circle of hills. The vein or deposit crops out at intervals for a hundred yards in the bottom of a branch, having a thickness at some points of from four to five feet, the line of outcrop extending in a northeasterly and southwesterly direction, and having a thickness at some points of from four to five feet. It occurs in horizontal limestone strata, belonging to the superior portion of the Lebanon limestone (lower part of Trenton period). Its outcrops rise in hard weathered plates, narrow hog-backs, which are more or less porous and consist in part of smithsonite, or carbonate of zinc (dry-bone of the Missouri miners), with some silicate and siliceous impurities. Several of these plates, from five to twelve inches in thickness, are seen at the different exposures. At one point, where a farm road crosses the outcrop, a banded structure appears to be seen, though obscurely, on account of the interference of water. Plates of stuff alternate with empty

spaces, and perhaps with plates of limestone. The hog-back plates are evidently the result of the weathering of the vein matter.

Very little work has been done toward the development of this deposit. Before my visit a considerable hole, perhaps eight feet deep, had been dug, from which much vein matter had been thrown out. This was mostly made up of a grayish barite and calcite, the barite predominating. In addition, there was considerable zinc blende and a very little galena. The hole above was nearly filled with water at the time of my visit, so that the vein matter was not seen in place.

As to whether we have here a true fissure vein, or a deposit of limited extent and depth, is not at present known. More work will have to be done before any just conclusion can be arrived at. This, like the Frazier mine, has been pronounced a "silver mine" carrying also some gold, but the assays made by us justify no such appellation. Our samples gave hardly a trace of silver and no gold. It may be called a zinc mine if it be desirable to give a name to it. It supplies two ores of this metal as stated above—smithsonite and zinc blende. What it would develop in the way of these ores, or in barite and galena, no one, of course, can tell without going down upon the mass. It deserves further attention.

A special survey has been commenced in the region of Roan Mountain, in East Tennessee, with a view to the character and age of the formations and their relation to the vein of magnetic iron ore which extends from the Cranberry Mines, in North Carolina, into Tennessee.

PART II.

REPORT ON THE AGRICULTURAL GEOLOGY OF TENNESSEE, EMBRACING SPECIAL NOTES ON COTTON CULTURE.

The southern boundary of Tennessee coincides mostly with the parallel of latitude 35° north; its northern limit is a broken line lying between the parallels of $36^{\circ} 29'$ and $36^{\circ} 41'$. In general outline the State has approximately the figure of a long rhomboid. Its mean length from east to west is about 385 miles, while its mean breadth cannot be much over 109 miles. Its land area is estimated to be 41,750 square miles; its water surface, 300 square miles.

VARIETY IN NATURAL FEATURES.

The length of the State, and the fact that it reaches, in its ribbon-like form, from the crest of a great mountain range on the east to the low alluvial plain of the Mississippi on the west, through a varied territory, gives to Tennessee its most prominent characteristic, to-wit: *great variety*. This is seen in its topography, geology, soil, climate, agriculture, and, we may say, in the character and habits of its population. As I have said elsewhere,* nearly all the important physical and geological features of the States around it are represented more or less (grouped as if for contrast) within its borders. Tennessee has, for example, on the one hand, some of the greatest mountain ridges of the Appalachians, with their "bald" summits and ancient rocks; on the other, the low land, cypress swamps and alluvial beds of the Mississippi River. It has also well represented the singular parallel valleys and ridges of Middle Virginia, the highlands, the "barrens" and the rich limestone lands of Kentucky, and the orange-colored sand-hills, the cretaceous beds and cot-

* *Geology of Tennessee*, 1869, p. 10.

ton soils of Northern Mississippi. The same variety and contrasts exist in the matter of climate, especially as to summer temperatures.

GENERAL TOPOGRAPHY AND ELEVATION.

To aid in understanding the topography of the State it will be well to assume and have in mind a great horizontal plane, having an elevation of 900 feet above the sea, with which to compare the *general surface*. Throwing out of view for the moment some of the local geographical features—that is to say, the mountain ranges of the eastern portion and the basins and valleys of the western—the general surface coincides more or less with this plane. I say more or less, for the surface is, in a degree, a warped one, coinciding at very many points with the plane, but at others either rising above or sinking below it.

The parts of the State approximately coinciding with our assumed plane of 900 feet elevation, or at least directly referable to it, are the great divisions named: the *Plateau Slope of West Tennessee*, the *Highland Rim of Middle Tennessee*, and the *Valley of East Tennessee*.

The Valley of East Tennessee is in its upper or northern part a few hundred feet above the plane, while in its central and southern parts it at first coincides and then very gradually falls below it. The highlands of Middle Tennessee in some counties, as in Lawrence and Wayne, present a flat surface 100 feet higher than our assumed plane, while in Montgomery and adjoining counties the corresponding highlands are considerably lower. The "ridge" in West Tennessee dividing the waters of the Tennessee and Mississippi Rivers, and including the summit-line of the great Plateau Slope, must at some points be nearly, if not quite, as high as the plane. Westward, however, the general surface sloping off towards the Mississippi, falls considerably below, and may be regarded as terminating at an average elevation of not far from 400 feet along the edge of the bluff escarpment which faces the alluvial plane of the great river.

Upon the surface, as described, rest the mountains of the State, the most important being the great ranges of the Unaka Region and the Cumberland Table-land. Cut out of it and below it are the Central Basin of Middle Tennessee, the Western Valley of the Tennessee River, and the Mississippi bottom region.

Politically, the State is divided into three large divisions, namely, West Tennessee, Middle Tennessee and East Tennessee. The first embraces all the counties between the Mississippi and Tennessee Rivers, including the whole of Hardin County, altogether less than one-third of the State; the second the counties between the Tennessee River and a line approximately dividing longitudinally the Cumberland Table-land, the largest division; and the third all the remaining counties in the eastern end of the State.

CLIMATE.

As already stated, in climate, as in other natural features, the State presents a marked variety. This is especially true of summer temperatures. The valley lands of upper East Tennessee have the summers of Ohio and New Jersey; the lowlands of Middle Tennessee the summers of the northern part of Georgia; while West Tennessee is warmed by the summer of the central parts of Georgia and South Carolina. And further, there is, as will be seen hereafter, an extended line of high points on the eastern border of the State which have the cool breezes of a Canadian summer, and are, to some extent, clothed with a Canadian flora.

The climate of the State, exclusive of its mountains, is in general midway in character between that of a temperate and that of a sub-tropical region, or rather it combines the milder features of the two. In common with a large part of the Valley of the Mississippi, the climate is subject to comparatively great extremes; yet these extremes never reach the excessive cold of the northern States or the highest temperature of the tropics.

Herbage is often green throughout the year, and cattle can generally graze with but little interruption from cold or snow,

during all the months of winter. Many shrubs which in States farther north lose their leaves during the winter, here not unfrequently retain them the year round. The daily changes of temperature are considerable, and, in common with a large area of the Mississippi Valley, the State has a full share of humidity and sufficient rains. It is a part of the region of which it is said "cotton, Indian corn and the cane find their natural climate here, but not elsewhere in any considerable degree beyond the tropics."

The *annual mean temperature* along a parallel running longitudinally through the middle of the State is, according to the best observations and estimates, about 60.5° for West Tennessee, 58.5° for Middle Tennessee on the meridian of Nashville, and 57.5° for the Valley of East Tennessee, the range being 3° . For the annual means of parts of West and Middle Tennessee, near the northern boundary of the State, one degree may be subtracted from each of the above numbers respectively, and for parts near the southern boundary one degree added. In East Tennessee two degrees must be added and subtracted respectively for the northern and southern means. These approximations are the best that can be made at present. In making them the temperatures of the mountain division—namely, the Cumberland Table-land and the Unaka Region—have not been considered.

The length of the period between the last killing frost of spring and the first killing frost of autumn is to the agriculturist an important element of climate. It is the measure of the growing season, at least so far as the cotton-plant is concerned. Not including the mountains, the average time for the last killing frost of spring is the middle of April in the northern counties of the State, excepting in those of upper East Tennessee, where it occurs a few days later. In the southern part of the State it is a week sooner. The average time of the first killing frost of autumn in the northern counties is the middle of October. It occurs a few days earlier in upper East Tennessee, and a week later in the southern counties of the State. The number of days between these frosts, that of spring and that of autumn, averages 189 for the northern part of the State and 203 for the

southern. Frosts, of course, may occur respectively before or after the times specified, but the probabilities are against it. Early frosts begin to be a source of apprehension before the last of September, especially in the more northern portions of the State, and the cotton crop often suffers more or less from them.

The latitude of Tennessee is such that a fall of two degrees of temperature in the northern part of the State might cause a killing frost, resulting in the destruction of the cotton-plants; while the same fall in the southern part would leave them intact. The length of the growing season for cotton is, at best, short enough in the southern part of the State, and where so slight a change of temperature produces such results we can readily see how, in the northern part, it may be generally too short for full crops, which in reality it is. It amounts nearly to the same thing to say that the margin of the cotton-growing section of the country runs through Tennessee.

In an inspection of the map showing percentage of aggregate areas in cotton, as compared with the entire area of any given region, it is seen that the counties in Tennessee which plant and produce the most cotton are strikingly the most southerly ones, and that from these the production decreases almost uniformly as we go north. This is especially so in West Tennessee. Now, in explanation of this, in great part at least, it is to be noted that the isotherms, or lines of equal temperature, for spring and fall extend west-northwest through the State, say parallel with a line running through Chattanooga and Trenton, or thereabout. This shows the southwestern corner to be the warmest, and here is our greatest center of cotton culture. The greater warmth stimulates the cotton, and by throwing back the killing frosts increases the length of the growing season. The soils have their influence, but that they are not dominant in this distribution of percentage of culture is shown by the fact that as we go north the decrease occurs, though the soils and elevation remain essentially the same. It is also noteworthy that as we go eastward from each of the two centers of cotton culture (the southwesterly corner of the State and the southern part of the Central Basin) the percentage of cotton culture rapidly de-

creases. The temperature and higher elevation obviously have much to do with this decrease.

The *rain-fall* for seven years (1873-1879) was: at Memphis, 54.40 inches; at Nashville, 51.98 inches; and at Knoxville, 54.52 inches, giving a mean of 53.60 inches. Our data indicate that we have the least rain in autumn and the most in winter and spring, yet so distributed through the months as to prevent any marked distinction into wet and dry seasons. The most favorable seasons are those in which the rain-fall is about a mean, provided it is suitably distributed among the months. It is more frequently too dry than too wet during the summer.

THE ROCKS AND SOILS IN GENERAL.

The varied character of the natural features of Tennessee, both geological and agricultural, have already been referred to. As to the latter, this variety is marked, and will appear further on. From the North Carolina boundary to a line nearly coincident with that part of the Tennessee River which flows north-westward across the State from Mississippi to Kentucky, the strata underlying the soils, excepting the limited river bottoms, are everywhere *hard rocks* of many varieties: gneissoid and half metamorphic conglomerates, slates and sandstones of the mountains to begin with; then calcareous shales, dolomites and limestones of the valleys, and calcareo-siliceous rocks of certain flat highlands. Much the greater part of the State, including the whole of Middle and East Tennessee, is made up of these hard rocks. Passing the line referred to, a wonderful change takes place. The hard rocks suddenly disappear, beveled off as if once a coast-line here washed by the waves; and, abutting against their beveled edges, begin strata little indurated of clays, sands, and other material, which spread over nearly the whole of West Tennessee. The latter strata, which we call, by way of contrast, *soft rocks*, are of much later geological age than the former, and give to West Tennessee characteristic features.

The strata of the State, be they soft or hard rocks, are approximately horizontal in position, excepting those of the Valley of East Tennessee and the Unaka Mountains, which are gen-

erally tilted, dipping to the southwest, often at a high angle, with their edges outcropping at the surface in long lines running northeast and southwest. The position of the strata has much to do with the topography of a country and with the extent and shape of its agricultural areas. Owing to the outcropping of the tilted strata of East Tennessee in long lines, it is a *fluted* country, made up of closely packed, long and narrow valleys and ridges, all running in straight courses to the northeast and southwest. Its best soils and agricultural areas occur, therefore, in long, narrow strips or belts separated by ridges. No such parallelism of valley and ridge is to be seen in the other parts of the State.

The soils are classified for the most part by the rocks, and it is the decay and disintegration of the latter which supply the inorganic materials. In Middle and East Tennessee, where, with unimportant exceptions, superficial drift formations are absent, the connection between the limestones, sandstones, shales, etc., and the overlying soils is very apparent. There being many kinds of rocks, there will be many kinds of soil, and the most important in the divisions just named are the calcareous soils; that is, those of the limestones, dolomites, and calcareous shales. With the exception of the limited alluvial areas of certain streams, the cotton of Middle and East Tennessee is produced, substantially, on calcareous soils.

The most important cotton soils of Middle Tennessee belong to two horizons of the Trenton limestone period, namely, the upper part of the Hudson River (Nashville) rocks, and certain beds of the lower part (the Central or Murfreesboro limestone).

In East Tennessee the little cotton cultivated is mostly found on the calcareous shale and dolomites of the Quebec (Knox) division of the Canadian period.

In West Tennessee the soils are chiefly based on sands, sandy clays, Loess (a calcaréo-siliceous earth), and alluvial deposits. They are for the most part mellow, warm, and well adapted to the growth of corn, cotton and tobacco.

THE NATURAL DIVISIONS OF THE STATE.

These have already been referred to, and are here briefly characterized. They are well defined, and will be taken as a basis in the arrangement of the matter, of this report.

1. The Mississippi Bottom Region, embracing the Tennessee portion of the great alluvial and low plain in which the Mississippi River has its tortuous bed; area, approximately, 900 square miles; average elevation above tide, about 260 feet.

2. The Upland or Plateau Slope of West Tennessee, including the entire area between the low bottoms of the Mississippi and the Tennessee Valley next mentioned. It begins with the line of bold bluffs or escarpments overlooking the bottoms, and gradually ascends eastward, embracing the ridge dividing the waters of the Mississippi and the Tennessee Rivers, respectively, and the highlands immediately beyond. Average elevation, 500 feet; area, 8,850 square miles, equal to one-fifth of the State.

3. The Western Valley of the Tennessee River, a comparatively narrow, broken area, through which the Tennessee River flows in its direct northward course from the State of Mississippi to Kentucky. The Valley is crowded between the breaks and slopes of two plateaus, the one just mentioned and the Highland Rim, lying next to the east. Average elevation, 360 feet; area, 1,200 square miles.

4. The Highland Rim, or Rim Highlands of Middle Tennessee, encircling, terrace-like, a basin of rich lowlands in the very center of the State. From the Valley last mentioned eastward to the western foot of the Cumberland Table-land, a distance of more than 100 miles, there lies a nearly square portion of the State. This area is a plateau having an average elevation of 1,000 feet above tide, out of the middle of which has been excavated a basin, named below the *Central Basin*. The part left intact is the Rim, a complete circle of flat highlands, with an area of 9,320 square miles, nearly two-ninths of the State.

5. The Central Basin. The basin surrounded by the Rim is thus designated. It is the central part of Tennessee, supplies the site of its capital and is the garden portion of the State. It

is oval in form, with longer and shorter diameters, respectively, of about 120 and 55 miles. Average elevation above the sea, 600 feet; area, 5,450 square miles, more than one-eighth of the State.

6. The Cumberland Table-land, usually known as Cumberland Mountain, is a plateau with broad and generally level top, and stands in bold relief above the lowlands on each side. It is capped with sandstone, and is the Tennessee coal field. Elevation, 2,000 feet; area, 5,100 square miles.

7. The Valley of East Tennessee. The great Valley of which Knoxville is the metropolis is a fluted region or succession of parallel minor valleys and ridges, and is one of the most beautiful and populous portions of Tennessee. It extends obliquely through the State, and is bounded on the west and northwest by the eastern escarpment of the Cumberland Table-land, and on the southeast by the Unaka Chain. Average elevation, 1,000 feet; area, 9,200 square miles, exceeding one-fifth of the surface of the State.

8. The Unaka Region comprises an area of bold mountain ridges, more or less parallel, having a general northeast and southwest trend, and inclosing many valleys and coves, and is the eastern mountain border of the State. The line separating Tennessee from North Carolina is, for the most part, the crest of the most easterly and highest ridge. Average elevation of summit, 5,000 feet above the sea; area, excluding the interlocked valleys and coves, about 2,000 square miles.

FIRST—THE MISSISSIPPI BOTTOM REGION.

That portion of the great alluvial plain of the Mississippi River pertaining to Tennessee, or, I might say, to Kentucky and Tennessee, is comparatively small. The course of the river is such on the western border of these States as to divide the plain very unequally, throwing much the greater part, popularly known as the Saint Francis bottom, into Missouri and Arkansas, and leaving a narrow interrupted strip in Kentucky and Tennessee.

In the latter States, as indeed farther south, the alluvial plain is bounded on the east by a sharply defined line of bold bluffs, or a bluff escarpment, the edge of the flat uplands which extend off eastward. This bluff escarpment, or edge, reaches in a nearly straight line from Kentucky, through Tennessee, to Mississippi. We shall call it the *Bluff*. The strip of the great plain belonging to Kentucky and Tennessee is interrupted and cut into a number of sections by the repeated bending in of the river to the Bluff. The river thus strikes the uplands at the following points: Columbus and Hickman, in Kentucky, and Fulton, Randolph and Memphis, in Tennessee.* The largest of the sections, and the most important so far as Tennessee is concerned, lies between Hickman and Fulton. This includes Madrid Bend and an area in Kentucky south of Hickman, but the main part is in Tennessee. The next most important section stretches from Randolph to Memphis. The section between Randolph and Fulton is inconsiderable, the points being but a few miles apart. Below Memphis begins the large division of the great plain known in Mississippi as the "Yazoo bottom." This belongs to the latter State, excepting the extreme northern end, which is in Tennessee. It is to be added that there is a number of cultivated islands in the Mississippi River which must be included in the Kentucky and Tennessee portion of the plain.

The alluvial plain of Tennessee has about the same general features as elsewhere. It is, or has been, forest-covered, much of it heavily so, and many parts are subject to overflow. It has its bayous, lakes and cypress swamps. The highest land, and that chiefly under cultivation, often called "front land," is generally a raised, wide bank or belt bordering the river, and formed by the deposition of alluvial matter in great overflows of the past, the overflowing water having lost the bulk of its earthy load as it first escaped from the deep and swift channel current. Going from the river and this higher land, the surface generally slopes off into lower "back lands," with "buckshot"

*Formerly, the river washed the uplands at another point, "Old River," as now known by some, in the southern part of Tipton County. The four points, Fulton and Randolph, "Old River," and Memphis, were once known as the four "Chickasaw Bluffs," Fulton being the first and Memphis the fourth.

clays and soils, finally ending, it may be, in a lake or a cypress swamp. Such at least are the typical features. This division embraces the whole of Lake County, about one-third each of Dyer and Lauderdale Counties, and a fraction each of Tipton and Shelby. It also embraces Reelfoot Lake and limited lands in Obion County. The entire area has been estimated to be 900 square miles, but this is probably an overestimate. * * * The cultivated land forms for the most part an interrupted belt along the Mississippi River, and has a width ranging from the fraction of a mile to two miles or more. The greatest single body of land lies in the middle and northern parts of Lake County, where the proportion in cultivation is estimated to be at least two-thirds of the area. In the southern part of Lake the proportion is not more than one-fourth, half of which is along the river. There is much timber land, and large bodies are subject to overflow. South of Lake County the proportion of land in cultivation is still less. In Dyer County the cleared land is a more or less broken strip bordering the river from half a mile to two miles wide, with an average width of one mile. There are, however, in this county many thousand acres fit for farming purposes as yet uncleared.

The following extracts from letters of correspondents refer to the Mississippi bottom region in Lauderdale County. The characteristics given, however, may in the main be taken as illustrative of the general features of the entire division in Tennessee. Mr. J. L. Lea, of Fulton, writes:

"A slip of cultivated land runs along the Mississippi River, and but little lies back from the river. The best and highest land is always along the river. The bottom about the mouth of the Hatchie is small. Hatchie bottom proper is about one mile or two miles wide, and has a slough of cypress timber and some tupelo-gum swamps. There is not much cultivation until you strike the second bottom along the foot of the hills.

"The main Mississippi Bottom Region of this county is the area lying between Coal Creek, Forked Deer River and Mississippi River, an area say eight to ten miles wide and fifteen or twenty long, and including 100,000 acres. I believe that in ex-

treme high water every spot of this has been covered, unless it be certain Indian mounds.

"There are farms in the bottom bordering the Mississippi River, but not along Coal Creek or Forked Deer River. It is three or four miles above the mouth of Coal Creek before the farms begin. I suppose 6,000 or 8,000 acres would cover all the cultivated land of the bottom. Cypress swamps exist all through the area, say 25 per cent. of the whole. I do not know that there are any tupelo-gum swamps in it; do not remember to have seen or heard of any. This bottom would be a magnificent tract of land were it not for the interference of the water. There is a disposition to bring it into use notwithstanding, and some persons are clearing more deeply overflowed lands than had been thought available. I have cleared some land having ten or twelve feet overflow, and make corn on it almost every year. I plant in June, and secure forty or fifty bushels of hard corn per acre. It is safer from overflow in summer than any creek or river bottom in hilly or mountainous countries. I suppose 25 per cent. of this bottom overflows two feet or less; 25 per cent. five feet or less; 25 per cent. ten feet or less, and the balance is made up of lakes and sloughs. Two-thirds of the cultivated land is in cotton. There is no road along the bank of the Mississippi River across the mouth of Coal Creek, and none, I think, across the mouth of old Forked Deer River, except, perhaps, in low water. Roads are found in all the farming areas. These statements are necessarily imperfect, and in some points may be incorrect."

Mr. J. C. Marley, of Ripley, writes:

"According to the best statements I can make there are about 100,000 acres of land between the Bluff and the Mississippi River termed bottom or overflowed land. This is equal to about one-third of the area of the county. Of this there is in cultivation about 8,000 acres, of which 5,000 are in cotton. Most of the cultivated land is near the river, and lies in a broken belt along its banks. There are a few patches of cultivated land out back from the river; and other land is also susceptible of improvement, some near the Bluff or highlands. A very little of this bottom land is entirely above the extreme high water, but

there is much of it on which the overflow is slight. I would estimate that on one-third of the land the water never gets more than two feet deep, and that on one-half it never exceeds four feet. It is thought by our best farmers on the river that a slight overflow is advantageous. The difficulty in cultivating land subjected to deep overflows is that the fences float away. There is no land in our county that produces so well as this bottom. A friend of mine near Hale's Point tells me that he has for the last eight years cultivated about fifty acres in cotton, and that it averaged each year 500 pounds of lint to the acre."

The bottom in Tipton County is estimated to average four miles in width. Farms occur at intervals all along the river, but none back until the Bluff is reached. This county includes also four islands, containing in the aggregate 17,000 acres, 2,500 of which are under cultivation. The bottom continues into Shelby, with the same general features as heretofore described.

The soils may be grouped into two classes, the "loams" and the "buckshot" clays. The loams prevail, and are dark and exceedingly fertile, at times clayey and stiff, and then sandy and mellow, sometimes becoming too sandy. The buckshot soils are subordinate. Mr. Lea says:

"The term 'buckshot' is applied to certain stiff, black soils which break up into small fragments when cultivated. These soils are not uniform in kind, and vary a little in color and in other characteristics. They are not generally found in very large bodies, as the overflows deposit sandy and loamy lighter soils at intervals upon them."

These buckshot soils are derived from a stratum of dark clay which extends throughout the bottom, and upon which, as a floor, the high waters deposit their alluvial load.

No analyses have been made of samples of the soils of this division taken from Tennessee. Analyses, however, have been made of the corresponding soils in other parts of the Mississippi plain which fairly represent the composition of those of Tennessee.

We select as typical the following analyses, the soil being found in the Yazoo bottom in Mississippi. They are extracted

from Prof. E. W. Hilgard's report on the cotton production of Mississippi.

No. 354. *Dark-colored, rather light loam*, from Tallahatchie County, Mississippi, a good representative of the "front-land" soils.

No. 376. *Grayish, rather sandy soil*, from Sunflower County, Mississippi. This land is reported as not much esteemed by farmers.

No. 394. *Stiff, pale gray loam*, with yellowish or orange flecks, so that, when worked up the soil is somewhat yellow. This soil is from Issaquena County, Mississippi.

No. 396. *Light "buckshot" clay*, taken from the edge of a depression or pond, Coahoma County, Mississippi.

No. 390. *"Buckshot" soil*, of Deer Creek back-land, Issaquena County, Mississippi. It is a stiff, dark-colored clay soil, traversed by numerous cracks, and mottled with spots of ferruginous matter. Upon drying it breaks up into little angular fragments. It is exceedingly fertile.

Mississippi River Bottom Soils, Mississippi.

	TALLAHATCHIE COUNTY.	SUNFLOWER COUNTY.	ISSAQUENA COUNTY.	COAHOMA COUNTY.	ISSAQUENA COUNTY.
	Tallahatchie bottom soil.	Indian Bayou front- land soil.	Sunflower River front- land soil.	Light-colored buckshot Clay.	Deer Creek buckshot soil.
	No. 354.	No. 376.	No. 394.	No. 396.	No. 390.
Insoluble matter.....	87.146	87.898	71.164	75.513	51.063
Soluble silica.....	4.798	4.036	13.506	10.895	20.704
Potash.....	0.301	0.226	0.401	0.606	1.104
Soda.....	0.084	0.116	0.191	0.146	0.325
Lime.....	0.301	0.153	0.406	0.386	1.349
Magnesia.....	0.385	0.256	0.696	0.972	1.665
Br. ox. of manganese.....	0.158	0.048	0.011	0.133	0.119
Peroxide of Iron.....	2.120	1.848	3.845	2.804	5.818
Alumina.....	2.151	2.565	6.889	4.457	10.539
Phosphoric acid.....	0.112	0.162	0.165	0.278	0.304
Sulphuric acid.....	0.005	0.042	0.016	0.007	0.024
Water and organic matter...	2.644	3.018	2.748	4.401	7.369
Total.....	100.205	100.363	100.038	100.598	100.383
Hygroscopic moisture.....	22 C.° 4.79	14 C.° 4.07	15 C.° 7.39	12 C.° 6.04	15 C.° 14.31
Absorbed at					

In giving these analyses, Professor Hilgard makes the following remarks :

“These soils are types of the prominent soil-varieties occurring equally on both sides of the Mississippi north of the mouth of Red River. Without entering into a detailed discussion of these soils in this place, it is important to call attention to the fact that in its store of plant-food of all kinds the ‘buck-shot’ soil stands pre-eminent above all the rest, and well justifies its reputation of being the most productive and durable soil of the great bottom. Unlike most other clay soils, it may be tilled at almost any time when the plow can be propelled through it, because, on drying, it crumbles spontaneously into a loose mass of better tilth than many an elaborately tilled upland soil. It is of such depth that the deepest tillage, even by steam plow, would not reach beyond the true soil material; and its high absorptive power secures crops against injury from drought. At the same time (owing doubtless to its being traversed by innumerable fine cracks and being underlaid by gravel and sand) it drains quite readily. In good seasons a large part of the cotton crop grown on this soil has often been left unpicked for want of labor, after taking off from 1,500 to 1,800 pounds of seed-cotton to the acre. Two bales of lint per acre can undoubtedly be produced on such soils with fair culture and good seasons.

SECOND—THE UPLAND OR PLATEAU SLOPE OF WEST TENNESSEE.

This large and important division is pre-eminently the cotton region of the State. Leaving the great bottom at any point, we ascend the Bluff to an average elevation of about 180 feet, and find ourselves upon a flat and wide-spreading Plateau. From the Bluff the Plateau extends eastward, gradually rising to the Tennessee Ridge, by which name the high belt of country which lies on both sides of the actual summit of the watershed, dividing respectively the waters of the Mississippi and Tennessee Rivers, and chiefly within the counties of Henry, Carroll, Henderson and McNairy, has been designated. The Plateau, or Plateau Slope, has from its western to its eastern limit

a mean length of about eighty-four miles. Its form is nearly rhombic, and its area 8,850 square miles. It is a section of a greater plateau lying in Kentucky, Tennessee and northern Mississippi, between the bottoms of the Mississippi River on the one hand and the Valley of the Tennessee on the other, and embraces in its area the following counties and parts of counties: All of Weakley, Gibson, Carroll, Crockett, Haywood, Madison, Henderson, Fayette and Hardeman; much the greater parts of Henry, McNairy, Shelby, Tipton, Lauderdale and Obion, and smaller parts of Hardin, Decatur, Benton and Dyer.

The division is well supplied with water-courses. The summit of the water-shed is so near the Tennessee River that much the longer slope is on the Mississippi side. On this side, therefore, the rivers are most characteristic. They are numerous and long for their water volume, and run in nearly parallel courses from the Tennessee Ridge northwesterly, until they intersect or nearly reach the line of the Bluff, when they turn southwesterly through the bottoms of the Mississippi River. These rivers have sluggish currents and usually a wide, flat bottom on both sides, bearing a heavy forest growth, and are often swampy and subject to overflow. Back from the immediate bottoms the surface often rises in "second bottoms," supplying arable lands of good quality.

The following data indicate the general elevation of the Plateau Slope. The Tennessee Ridge, or belt of highlands referred to, has in the southeastern part of the division, in McNairy and Henderson Counties, an elevation above tide of from 500 to 600 feet. Some points exceed this, probably reaching as much as 800 feet. From Jackson northward the elevation ranges from 400 to 500 feet, and going toward Memphis the elevation falls considerably below 400 feet. The Bluff has a mean elevation of about 400 feet. At Memphis its height is below the average both as to the sea and as to the Mississippi; at Randolph its height above both is an average. Passing northward, its elevation above tide becomes greater, but remains about the same as to the Mississippi.

We divide the Plateau Slope into three subdivisions, as follows:

- (a) The Bluff Region.
- (b) The Brown Loam Table-lands.
- (c) The Summit Region of the Water-shed.

(a) THE BLUFF REGION.

The Bluff Region includes nearly the whole of Obion County and the larger parts of Dyer, Lauderdale, Tipton and Shelby Counties. It is a belt of country from twenty to twenty-five miles wide, extending from Kentucky to the State of Mississippi, and lies east of and adjoining the Mississippi bottom. Its eastern limit is approximately coincident with that of the tier of counties mentioned. Its soil is a calcareo-siliceous loam, often called clay, based on yellowish-gray or often an ashen-colored Loess, more or less calcareous.* The Loess itself rests on a bed of gravel and orange sand, which sometimes appears at the surface, especially near the eastern margin of the belt, in washed places and road-cuts. The upland soil is the prevalent one, and varies in color from a gray or ashen to a brown or dark loam, is deep and mellow, in fine pulverulent condition, easily tilled, contains more calcareous matter than is ordinarily met with in the soils of this part of the State, and is altogether a superior upland soil. It is remarkable for its forest growth. In some sections it supplies the largest trees to be found in the State—great “poplars” (tulip trees), oaks, sweet-gums, elms, hickories, walnuts, sassafras (growing up like great pine trees with long trunks), beeches, and other trees, reaching dimensions much above the average. In favorable seasons, from 1,500 to 1,800 pounds of seed-cotton are often raised per acre upon the best of this land. Shelby, the most southerly county of the belt, produced in the main upon this soil in the census year more cotton than any other county of the State, besides making good crops of Indian corn and oats. Owing to long or improvident culture, the soil in some sections is more or less exhausted.

*This formation—the Loess—can be satisfactorily studied in the bluff at Memphis. All the material of the bluff here above high-water mark belongs to it. The cuts made for the streets and railroads expose it well. The gravel and sands underlying the Loess at this point can only be seen at low water.

Its substratum, however, is strong in the elements of fertility, so much so that the soil, unless badly cut up by washes, is susceptible, when impoverished, of great improvement, or even restoration.

In addition to the uplands, the second bottoms of the streams, both of creeks and rivers, supply a large aggregate of arable land of good quality, the soils being strong loams or mixed soils composed of ingredients from the Loess and subjacent strata. And further, the alluvial dark bottom lands of the creeks, if escaping ordinary overflows, are often very fertile and durable. As a general thing, the bottoms of the rivers are clayey and cold, but they sometimes present areas prized for their fertility.

The following analyses of a representative soil and subsoil and of the Loess of this region are given. The specimens were taken and averaged with care, in accordance with directions given by Prof. E. W. Hilgard :

No. 15. *Upland soil* from a poplar grove at Gill's Station, two and one-half miles east from Memphis, Shelby County. Depth, 6.2 inches; timber growth, chiefly poplar (tulip tree), sweet-gum and hickory; also sugar maple, red and other oaks, red-bud and dogwood. The soil, after drying, has a light, brownish-gray or ashen color.

No. 16. *Upland subsoil*, taken below the above soil. Its appearance, with the exception of a yellowish cast, does not differ very much from the soil.

These analyses have representative value, but it will require the analysis of many such specimens, selected from all the counties of the belt, to give true averages of the composition of this upland soil and of its most important varieties.

No. 17. *Loess* from the river bluff at Memphis, Shelby County, taken at 12 inches. This specimen was selected by J. G. Snedecor, Esq., of Memphis.

Lands of the Bluff and Loess Region, Shelby County.

	GILL'S STATION.		MEMPHIS BLUFF.
	Upland Soil.	Upland Subsoil.	Loess.
	No. 15.	No. 16.	No. 17.
Insoluble matter----	84 646 } 89.113	83 128 } 86.981	73.112 } 76.503
Soluble silica-----	4.466 }	3.853 }	3.390 }
Potash -----	0.332	0.399	0.433
Soda -----	0.085	0.181	0.180
Lime -----	0.248	0.243	3.967
Magnesia -----	0.677	0.438	3.291
Brown oxide man-			
ganese -----	0.030	0.042	0.094
Ferric oxide -----	2.416	3.664	4.687
Alumina -----	2.333	5.026	3.102
Phosphoric acid ----	0.083	0.064	0.319
Sulphuric acid -----	0.080	0.010	0.060
Carbonic acid -----			5.561
Water and organic			
matter -----	4.159	2.620	1.730
Total -----	99.555	99.668	99.927
Hy'scopic moisture--	5.00	6.31	4.67
absorbed at-----	16 C.°	17 C.°	16 C.°
Humus -----	1.062		
Inorganic matter --	0.972		
Available silica-----	0.473		
Available phosphoric			
acid -----	0.049		

[The soil and subsoil from Gill's Station, while having a fair amount of potash and lime, are deficient in phosphoric acid. More than one-half of the latter is in an available form in the soil, as shown in the humus determination. The Loess, much less sandy than the other soil, is also richer in potash, and contains large percentages of lime and phosphoric acid, as well as of magnesia. Its organic matter is low.—*R. H. L.*]

(b) THE BROWN LOAM TABLE-LANDS.

The region of the Brown Loam Table-lands constitutes the largest and most important agricultural subdivisions of the Plateau Slope. These table-lands present a belt-like area, ex-

tending through the State, twice as broad as that of the Bluff Region, and embraces the following counties, which we may call the *midland counties* of the Plateau Slope: Fayette, Harde-man, Haywood, Madison, Crockett, Gibson and Weakley, together with large parts of Carroll and Henry, and small parts of other counties. Its area is about 4,450 square miles, or about half that of the entire Plateau Slope.

Of the counties mentioned, the first seven only are considered in the remarks immediately below, Carroll and Henry being included in the third subdivision, and the fractional parts of the others in the first and third. The subdivision, as thus limited, supplies about five-twelfths of the entire cotton product of the State, besides being surpassed by only two sections in the yield, respectively, of Indian corn and tobacco (the Central Basin in corn and the western subdivision of the Highland Rim in tobacco—both sections of Middle Tennessee).

The table-lands subdivision, including the counties and parts of counties first enumerated, is a plateau region of moderately rolling uplands cut into sections by the numerous rivers and their tributaries. The formation underlying the soils and subsoils is the Orange Sand of the Drift. The orange, yellow, and sometimes gray sands of this formation are often seen in the railroad cuts, in gullies, and in bluffs on the rivers, at depths below the subsoil of from three to ten feet or more. The soil of the uplands is, of course, the prevailing one. It is a brown, or, when moist, blackish, warm, siliceous loam, noted for its mellowness, and on slopes is easily washed, and therefore requires careful handling. The subsoil is reddish-brown, and more clayey than the surface soil. The soil is well suited to the culture of cotton, especially in a region like that of West Tennessee, where the shortness of the growing season (the period between killing frosts) makes early maturity desirable. The same belt of country and soil extends far into Mississippi, where it contributes largely to the production of the best upland cotton in that State. The soil is tolerably uniform in character, though here and there sections occur which, by their more stunted natural growth, show them to be below the aver-

age fertility.* In many districts the soil has been more or less injured by bad or improvident culture, and can no longer yield as formerly. In this way lands once of first grade have been reduced to the second or even third grade. Where it is not too late it should be looked to that no further deterioration of this kind shall occur, and that the soils which have suffered shall be brought back to something like their primitive strength and fertility.

The characteristic native growth of the soil is oak—white, red, black, Spanish, post and black-jack oaks. Hickories are common, with “poplars;” also some walnuts, maples, chestnuts, dogwood, hazel-nut, and many other trees and shrubs. Rarely patches of poorer sandy spots are met with having a growth of pine trees.

The soils of the second bottoms, though generally not the best for cotton, may be richer than those of the uplands. When mellow and gravelly, they are often in dry seasons the best for cotton. The bottoms, above overflow, have sometimes a very fertile soil. Then, again they are too clayey and crawfishy.

No analyses have been made of samples of soils from this subdivision in Tennessee. Fortunately, however, the belt extends into the State of Mississippi, and the analyses of its soils there will, doubtless, fairly represent their composition here. The following analyses are taken from Professor E. W. Hilgard's report on cotton culture in Mississippi:

No. 216. *Soil from the table-lands* on the divide between Coldwater and Wolf Rivers, near Lamar, Benton County, from a level tract below Summit Ridge. *Timber, black-jack, post oak and hickory, with some sweet-gum and a few Spanish oaks. Depth taken, ten inches; quite mellow, and of a “mulatto” tint.

No. 235. *Subsoil* of the above, ten to twenty inches.

No. 219. *Subsoil* from same section of land, but taken on the Summit Ridge itself; resembles the last.

* It may be remarked here that the upland soil of this subdivision merges insensibly into that of the Bluff Region. Both are mellow, siliceous soils, and in their best condition are very fertile. Many of the correspondents treat the soils of the two subdivisions as one, and so speak of them in their reports. The underlying Loess of the Bluff thins out eastwardly to a feather edge overlapping the Orange Sand, the two often, doubtless, contributing to the formation of the same subsoil.

Brown Loam Table-lands of Mississippi.

	Soil.	Subsoil.	Ridge subsoil
	No. 216.	No. 235.	No. 219.
Insoluble matter-----	83.347	83.993	82.830
Potash -----	0.549	0.700	0.630
Soda -----	0.082	0.041	0.090
Lime -----	0.245	0.139	0.270
Magnesia -----	0.479	0.597	0.450
Brown oxide of manganese-----	0.760.	0.332	0.060
Peroxide of iron-----	4.798	3.862	5.110
Alumina-----	6.282	7.729	8.090
Phosphoric acid-----	0.068	0.236	0.210
Sulphuric acid -----	0.062	0.054	0.020
Water and organic matter-----	4.195	2.716	3.140
Total-----	100.867	100.399	100.900
Humus -----	0.787	-----	-----
Available inorganic-----	0.668	-----	-----
Hygroscopic moisture-----	6.84	7.42	-----
Absorbed at-----	17 C.°	17 C.°	-----

Professor Hilgard thus discusses these analyses :

"The common chemical characteristics of these soils, and especially of their subsoils, are high percentages of potash and lime, with usually a large supply of phosphoric acid in the subsoil, at least of the heavier lands. Potash is not likely to become deficient in the subsoils at least; but the supply of humus is not large (as in fact is evident from inspection), and green manuring is one of the most important improvements indicated. Originally this was not the case, for the surface soils were, and in protected spots still are, dark-colored to almost black when wet; but the washing away of the surface and the burning of the woods have served to deplete the surface of this and other important ingredients, so that over a large portion of the region it is the subsoil, and not the surface soil, as given in the analyses, that the farmer has to deal with. In this case the addition of vegetable matter is, of course, doubly important; and green-manuring of denuded tracts with cowpeas is one of the most convenient, as it has proved to be one of the best, means

of improvement. The analyses show that so long as the sub-soil remains the question of restoration of a 'tired' soil is simply one of time and judicious management."

(c) THE SUMMIT REGION OF THE WATER-SHED.

This is the part of the upland or Plateau Slope through which the Tennessee Ridge extends in its nearly south and north course from the State of Mississippi to Kentucky. The summit line of this ridge, dividing the waters of the Mississippi from those of the Tennessee, passes through the counties of McNairy, Henderson, Carroll and Henry, and the region is made to include the counties of McNairy and Henderson, the eastern parts of Henry and Carroll, and the western parts of Hardin, Decatur and Benton. On the west it merges gradually into the second subdivision, the Brown Loam Table-lands, and on the east reaches the breaks of the highlands, finally sinking away into the Western Valley of the Tennessee River. Its breadth along the Mississippi State line is thirty-five or forty miles; but it grows narrower as we go north, until along the Kentucky line the breadth is reduced to eight or ten miles. The area is about 2,830 square miles. Though containing tracts of level land, it is, as a whole, very broken. In some of the counties, as in McNairy and Henderson, the ridges are high and bold, presenting many wild and picturesque sections. In the northern part of the area the Valley of the Big Sandy traverses it longitudinally, and modifies to some extent the roughness of its features. The mean elevation of the water-shed and the heights of the ridges were referred to in discussing the elevation of the entire Plateau Slope.

The streams are generally small, those on the western side of the summit line being merely head-waters of rivers flowing into the Mississippi, while those on the eastern side are necessarily small on account of the proximity of the summit to the Tennessee River. The Big Sandy has such a course as to make it exceptionally large and long. Beech River, rising in Henderson and crossing Decatur County, is the next most important stream. The other streams consist of creeks and branches, some of the former being of noteworthy size.

The soil most frequently met with is a sandy loam derived from both the Orange Sand and older sandy strata. There is, however, a great variety of soils, the subdivision embracing, to a great extent provisionally, belts of country having different soils with different formations underlying them. Approaching the Mississippi State line, this variety is more marked, the area becoming easily separated into belts, each with a soil and a surface more or less distinct. Just within Mississippi, where they have been much more thoroughly studied than in Tennessee, they are named as follows, commencing with the most westerly: The *Flatwoods Belt*, the *Pontotoc Ridge*, the *Short-leaf Pine and Oak Sandy Uplands*, the *Black Prairie Belt*, and lastly the *Short-leaf Pine and Oak Sandy Uplands* again.

The *Flatwoods Belt* extends through Tennessee, though its name is not especially descriptive of its surface or topography here, for it is often broken and hilly. Its characteristic underlying strata are beds of laminated or slaty clays, of dark color when wet, but light gray when dry, and varying in thickness from an inch to a hundred feet or more. With these are interstratified more or less sand. Often, however, these strata are covered or concealed from view by the deposits of the Orange Sand formation. The soils are of two general classes, the clayey and heavy and the sandy and light, in accordance with the character of the strata upon which they rest. The superficial Orange Sand contributes a large proportion of its mellow light soil.

The *Sandy Pine and Oak Uplands* occur in two belts. We consider the more westerly first. The *Pontotoc Ridge* area extends from Mississippi into Tennessee, but soon runs out, and is lost in the sandy pine and oak uplands. This area brings with it calcareous strata, limestone even, while a little to the west of it occurs "green (glauconitic) sand," much like the "green sand" of the black prairie belt, to be described. Such formations exist in the southeastern corner of Hardeman County. With them, however, are many beds of interstratified sand, showing often interlaminated clayey leaves. Going north, the calcareous and glauconitic materials disappear, and give place to laminated sands; but as with the Flatwoods, so here the Or-

ange Sand has spread its material over a great part of the belt, concealing the older beds, and in many sections giving character to the agricultural features of the surface. As provisionally given upon the map, including the area made by the projection of the Pontotoc Ridge Belt into the State, the sandy pine and oak uplands form the largest of the belts of the Summit Region, reaching throughout the State. On the Mississippi State line it is fifteen miles wide, but has a less average width, and it is exceedingly varied in agricultural features. It has areas of poor pine uplands, but these make in the aggregate little of its surface. It is in the main rough and broken, yet there are numerous large bodies of arable land, which lie well and are productive. Some of these are uplands, others valley lands, of which those of the Big Sandy are to be noted.

The *Black Prairie Belt* adjoins on the east the region just described. It is well known in Tennessee as a distinct area, but the designation *Black Prairie* is more generally applicable in Mississippi than in Tennessee. The characteristic underlying formation is known as "green sand," and farther south as "rotten limestone." It is a great bed, at some points 300 feet deep, of clayey sand, highly calcareous, containing green grains of a soft substance (glauconite), and at many points abounds in fossil sea-shells, among which are huge oyster shells. The belt thus characterized has, commencing with the Mississippi line, an average width of about eight miles for at least half way through the State. Farther north it becomes inconspicuous, and its limits in this direction have not been satisfactorily made out. It extends through the eastern parts of McNairy and Henderson Counties and the northwestern corners of Hardin and Decatur. Much of it is very hilly and rough.

The soils of the belt, where resting upon the green sand, and normally formed from them, are more clayey and calcareous than is usual in West Tennessee. We would naturally look also for a greater percentage of potash in them, as the substance of the "green grains" contains this constituent in its composition. Where the land lies well this soil is often strong and fertile, and on ridges it is usually sandy and thin. The subsoil derived from the green sand is from two or three to twenty feet

in depth. It is a grayish or dirty buff, tenacious material, locally called "joint clay," from its tendency to cleave when drying in irregular block-like masses.

At numerous points in McNairy and Henderson Counties the green sand comes to the surface, forming "glades" or "bald places," spotted over with a stunted growth of trees or shrubs. In these places the formation often presents a gray marly surface, with little or no depth of soil or subsoil.

It is to be observed, however, that a large proportion of the soils of the belt are not those of the green sand. As in the belts described, over much of the area the Orange Sand covers and conceals all else, supplying on level or rolling spots its mellow, fertile soil, or on rugged places a sandy or and gravelly one, of little or no fertility.

The last belt of the Summit Region is the eastern belt of the *Sandy Pine and Oak Uplands*. This in its underlying formations and soils is much like the first belt of this name. Much of it is covered with the Orange Sand, which here often includes beds of gravel. It occupies a belt of country varying from two to eight miles in width, and extends northward more than half way through the State. In Hardin County it reaches the Tennessee River, and here forms a part of the immediate valley of the river. This part is only included in the Plateau Slope of West Tennessee, for the reason that its formation, a sandy one, naturally belongs to this division of the State; and the same may be said of that part of the Black Prairie Belt lying in the western part of Hardin and the eastern part of McNairy Counties.

THIRD—THE WESTERN VALLEY OF THE TENNESSEE RIVER.

This division has been briefly characterized before. As compared with the Plateau Slope just described, it shows a marked falling off in the percentage of land in cotton. The northeastern part of the division, that east of the Tennessee and north of Duck River, is in the "penumbral region" of cotton culture, very little cotton being produced. Passing from this to

the southwestern part, the percentage rises, until the western portion of Hardin County, and on the eastern border of McNairy it reaches the maximum for this division.

The Western Valley, as already stated, is a long, narrow, and comparatively broken area, crowded between the spurs and breaks of two plateaus—one on the west and the other on the east side of the Tennessee River. Its limits on both sides may be taken to be the lines respectively along which the highlands for the most part break away. As thus limited, it has an average width of not more than ten or eleven miles, with an area, say of 1,200 square miles (a small portion of the State), and embraces the greater parts each of Benton, Decatur and Hardin Counties, much of Henry, a little of McNairy, the western portions of Stewart, Houston, Humphreys and Perry, and the northwestern corner of Wayne. The bounding highlands on both sides are fringed with numerous spurs, many of which run within two or three miles of the river, and some quite to it. Interlocked with the spurs, the Valley sends out many ramifications, among which are the narrow valleys of the tributaries of the Tennessee River, not a few of which run back ten or fifteen miles, and some twenty or more, before they terminate. Some of the creek valleys of Hardin and Wayne are among the longest ramifications. These are serpentine and narrow, averaging not more than a mile in width, but at many points very fertile. The spurs separating them are high, flat-topped arms of the highlands, like most of the spurs on this side of the Valley. Buffalo River, with the lower part of Duck River, in Wayne, Perry and Humphreys Counties, presents in its valley an important ramification. This, however, and the upper parts of the long creek valleys mentioned, are to be regarded as deep cuts in the division next considered, the Highland Rim. The Valley of the Big Sandy is a ramification on the western side of the division.

Taking the high-water elevation of the Tennessee River as the floor of the Valley under consideration, its average elevation above tide is about 360 feet. The depth of the Valley below the highlands that bound it on the east is, say, 500 feet, and below those on the west not far from 350 or 400 feet.

The formations of the division are of many kinds. We have, in our progress eastward, the last of the sandy and clayey strata of West Tennessee and the first of the solid strata, the limestones and siliceo-calcareous strata of Middle Tennessee. It thus includes the junction of the soft rocks of the one with the hard rocks of the other—a junction which appears to mark the position of the ancient coast-line referred to on a previous page. Here and there, also, overlying the formations on each side of the junction, and, indeed, on both sides of the Tennessee River, are patches of sandy material and gravel pertaining to the eastern margin of the Orange Sand Drift.

In the more southern counties (Decatur, Perry, and the eastern part of Hardin and Wayne,) numerous “glades” are met with—gravelly, marly places, resulting from the appearance at the surface of a gray, often shaly, limestone, with but little or no covering of soil. With the exception of patches of bushes or shrubby cedars, these places are nearly naked. These glades are sometimes several acres in extent, and make in the aggregate a large area, occurring usually on hillsides and slopes, but often forming the surface of isolated and low knobs, and are wholly different from those before spoken of as characteristics of the “Black Prairie Belt.” In another section of the Valley, however, the western part of Hardin and the eastern part of McNairy, many of the glades of the Black Prairie Belt do occur, which have been already noticed in connection with the belt to which they belong.

Alluvial bottoms occur alternately on the two sides of the river. These are not often more than a mile wide; yet their aggregate area is very considerable. The bottoms usually have high “front-land” along the river and lower “back-land” away from it, the latter sometimes running into swamps, often cypress swamps. The bottoms of the tributary creeks, also, are to be taken into account, as they make an important addition to the agricultural capabilities of the valley.

This variety in formation gives a great variety of surface and soil. The alluvial lands are generally very productive, and yield abundant crops of Indian corn, the chief product. Much of the second bottom and arable sloping lands of this division

and of the ramifications running out of it, especially on the eastern side of the river, are made gravelly by the angular, flinty *debris* from the siliceous rocks of the ridges, and where not worn too much are generally very mellow, productive lands.

Some of the limestone lands, also, are gravelly, from the liberation and shivering of the flinty seams contained in the underlying rocks. To these may be added patches of gravelly land resting on the water-worn gravel of the drift. Areas of flatwoods land occasionally occur, as in Hardin County.

The chief products of the Valley are, in the order of greatest importance, Indian corn, wheat, cotton, oats and tobacco. With these also must be given peanuts, a crop of no little importance in some sections. While most of the cotton is the product of the southern part of the division, most of the tobacco comes from the northern part.

FOURTH—THE HIGHLAND RIM.

The general topographical characteristics and the limits and area of the Highland Rim have been briefly given. It is a great rim of flat highlands, within which lies the Central Basin. I have divided the area, for convenience, into two subdivisions, the western and the eastern. The first includes the following counties and parts of counties: Montgomery, Robertson, Dickson, Hickman, Lewis, Wayne, Lawrence, the greater parts of Perry, Humphreys and Stewart, considerable portions of Giles, Hardin, Williamson, Cheatham, and Sumner, and small parts of Maury and Davidson. The second includes the greater parts of Macon, Clay, Overton, Putnam, DeKalb, White, Warren, Coffee and Franklin, considerable parts of Jackson, Cannon, Moore and Lincoln, and small portions of Smith, Bedford, Van Buren and Grundy.

As a cotton area the Highland Rim is of little importance, the most of it being referable to the "penumbral" region of cotton culture. It did not in all produce in 1879 more than 4,000 bales, and of this five-sixths was reported as the product of three counties, Hickman, Wayne and Lawrence. The cotton yield of the entire division was not during the same year a

third of that of Rutherford, a county of the Central Basin. And further, most of the cotton accredited to the three counties mentioned was not raised upon the highlands, but in the deep valleys traversing them—valleys which, with their soils and rocks (those at least of Hickman and Wayne), can be regarded as ramifications either of the Central Basin on the one hand or of the Western Tennessee valley on the other. Thus, but little cotton came from the highlands proper. The exceptions are certain southern parts of Wayne and Lawrence and the cotton-producing land of the eastern subdivision, most of the latter being on the highlands. It may be observed that the line separating the two chief cotton regions of Tennessee may be drawn at the western subdivision of the Rim.

In this large division the depth of the soils, together with the underlying earth or *debris* down to the rocks, is often very great. This is seen in digging wells, in the railroad cuts, and in the great excavations made at the iron-ore banks, nearly all of which west of the Cumberland Table-land are within the area of the Rim. For the most part the soils and all the earthy matter below them have been derived from the decay of the underlying solid rocks in the place. The exceptions are due to the occurrences here and there, often on the highest flats or summits, of spots in which the soils rest upon water-worn gravel, the latter being outlying patches of the Orange Sand Drift. Often the worn gravel is mixed with the angular cherty *debris* which has never been transported.

There are two chief soils in this division, the *siliceous* and the *calcareous red clay*.

The *Siliceous soil* is thin, often light colored, and rests upon a yellowish, sometimes reddish, clay soil. It is, as a rule, gravelly, made so by the angular, flinty *debris* of layers of the underlying formation, the latter in general a siliceo-calcareous rock, but often varying from a limestone in one locality to beds of massive chert in another. So far as the rocks and soils are concerned, extensive portions of the area of the siliceous soils, especially portions bordering the Central Basin, may be said to be "leached" sections of country; that is to say, sections more or less deprived of calcareous matter by the action of water.

They are now regions of freestone water, and as such, in connection with their elevation and the fact that they often supply springs of sparkling sulphur water, present acceptable sites for summer retreats, both for invalids and for pleasure-seekers. The leached condition is indicated by the freestone water, the poverty of the soil, and the frequent occurrence of massive layers and bluffs of chert once interstratified with or containing calcareous matter.

The land in general is arable, yet sparsely cultivated, most of that in cultivation pertaining properly to the area of this soil lying in the shallow valleys of the smaller streams. The chief products are Indian corn, wheat, oats and tobacco. Much of the area is in woods, presenting, indeed, in many parts, extensive flatwoods with open growth, chiefly oaks of modern size. Many such sections are known as "the barrens." In dry places black-jack and scrubby red, Spanish and black oaks are met with; in swampy areas, willow and water oaks; then again a better class of timber occurs, especially on slopes, such as white oaks, hickories, chestnut, poplar and sourwood.

It may be added that within the limits of the siliceous soil there are certain regions of variable extent whose soils approach in agricultural characteristics the calcareous red clay next described, and make, indeed, a transition from the siliceous to the red clay. In these transition areas the rocks making the red clay soil begin to appear. The areas may be found in both subdivisions of the rim, but occur most extensively on the mid-way highlands between the Central Basin and the western valley of the Tennessee River. But in these, as elsewhere within the limits of the siliceous soil, the lands mostly in cultivation are those of the valleys.

The *Calcareous Red Clay* is one of the strong, fertile and durable soils of the State, ranking in many sections next to the blue-grass soils of Kentucky and Tennessee. It is a great tobacco, corn and wheat soil in both the States mentioned, and a good cotton soil in Alabama, and nearly one-third of the entire tobacco crop of Kentucky was produced in 1879 upon this soil. Montgomery and Robertson, the leading tobacco counties of Tennessee, have this for their chief soil. It is warm, mellow

and easily tilled, much of which is due to its being tempered with the fine gravel and siliceous grains of crumbling chert. When first broken it is a brown loam from four to six inches deep, which changes to red by cultivation, becoming mixed with the red clay subsoil.

The rocks underlying the red clay soil belong to the St. Louis group of geologists. They are generally pale-blue fossiliferous limestones, containing often cherty layers or nodules. By disintegration and decay these rocks supply, more or less abundantly, masses of leached, spongy, fossiliferous chert, which are scattered over the surface and through the earthy matter below, becoming, indeed, everywhere characteristic of this soil area. The red color of the subsoil is due to iron oxide liberated by the half-way decay or leaching of the chert layers or of flints, which originally in the limestones were rich in iron.

A marked feature of the area of the calcareous red clay, and one well-nigh universal, is the presence at the surface of hopper-shaped sink-holes. These are very numerous in the Rim and Highland regions of both Tennessee and Kentucky. They communicate with caves below, through which flow subterranean streams, the whole making an underground system of drainage of great extent.

A large section of this red clay range lies in Kentucky and Tennessee, chiefly within the great bend of the Cumberland River. Much of this in the southwestern part of Kentucky, and reaching a little way into Tennessee, was formerly known as the "Barrens," and has a curious history. The following is from the first volume of Owen's *Geological Report of Kentucky*.

"In the early settlement of Kentucky the belt of country over which it [the red clay soil] extended was shunned and stamped with the appellation of "Barrens." This arose, in part, from the numerous cherty masses which locally encumbered the ground, in part from the absence of timber over large tracts, and in consequence of the few trees which here and there sprung up, being altogether a stunted growth of black-jack oak [black], red and white oaks. The value of the red calcareous soil of the "Barrens" is now (1856) beginning to be appreciated,

so that lands which formerly were considered hardly worth locating are now held at \$25, \$30, and, in the neighborhood of some towns, even as high as \$50 an acre. At the present time the so-called "Barrens" of Kentucky are, to a considerable extent, timbered with the above varieties of oak, hickory, and occasionally butternut, black walnut, dogwood and sugar-tree. The old inhabitants of that part of Kentucky all declare that, when the country was first settled, it was for the most part an open prairie district, with hardly a stick of timber sufficient to make a rail, as far as the eye could reach, where now forests exist of trees of medium growth obstructing entirely the view."

Another large and important section lies in a belt immediately west of the Cumberland Table-land. This belt extends in both directions through Tennessee, northward into Kentucky and southward into Alabama. A limited and isolated area in Cannon and DeKalb Counties occurs around the base of the Short Mountains.

The growth of the red soil is chiefly oak; that of the "Barrens" is spoken of in the quotation given. Omitting the black-jack oak, many flat portions of the area of this soil in Tennessee, outside of the region referred to, have a similar growth. In sections with a rolling surface, on slopes and in the valleys, the timber is often heavy. Good-sized oaks, white, black and red, abound, with more or less poplar, ash, black-gum, walnut, and in places wild cherry and sugar-tree.

FIFTH—THE CENTRAL BASIN.

The form and area of this important division, as well as its relation to the Highland Rim, have been previously given. This division is the most populous portion of Tennessee, and is the center of wealth and political influence, and in its varied agricultural capabilities is the garden spot of the State. It supplies, as before stated, one of the centers of cotton production. The soils are suited to the production of all the great leading crops. Indian corn is the chief product, and in this the Basin is much ahead of any other division. Then, in the order of acreage cultivated, follow wheat, cotton, oats, rye and tobacco.

Furthermore, in many sections pasture-lands abound, carpeted richly with "blue-grass" (*Poa pratensis*) and other nutritive grasses, on which live stock of all kinds graze and mature.

The Basin is mostly well defined on all sides by the steep escarpments of the highlands which surround it and rise from 800 to 500 feet above its floor. Their tops reach approximately the same general elevation, that of the Highland Rim making a high border, which, from favorable points within the Basin, presents itself to the eye as a level, wide-reaching horizon. The border, however, is a fringed one, made so by the multitude of ridges and spurs jutting in from the encircling rim.

The division is crossed by three rivers, the Cumberland, the Duck and the Elk, which descend from the eastern side of the Rim, flow in a more or less westerly direction, and finally escape from the Basin through comparatively narrow and often rugged valleys cut severally through the northwestern, western and southwestern sides of the Rim.

It will aid in understanding the topography of the Basin to state that if the narrow valleys or outlets through which the three rivers mentioned make their escape were filled up to the general level of the highlands, the entire Basin would fill with water, and become a lake 120 miles long and fifty miles wide. At Nashville the water would be 800 or 400 feet deep, and one might sail over the city and never recognize its site. The summits of the highest hills in the Basin would appear above the water as low, scattered islands.

The following counties and parts of counties lie within the division: All of Trousdale, Wilson, Rutherford and Marshall; nearly all of Smith, Davidson and Bedford; the greater parts of Sumner, Williamson, Maury, Giles, Lincoln and Moore; large parts of Jackson, Cheatham and Cannon, and small parts of Macon, DeKalb, Putnam and Coffee.

The surface of the Basin is in the main rolling, but level tracts abound. Here and there, especially as summit lines, separating the areas drained respectively by the different rivers and creeks, ridges more or less conspicuous start up, whose slopes are green with grasses, or, when in the wild state, are

heavy with timber. Then again, limited sections are met with which are hilly or made wild with groups of interlocking ridges. There is one great ridge, known as Elk Ridge, which is remarkable and merits notice. It is, in fact, an almost unbroken though narrow arm, running entirely across from one side of the Highland Rim to the other, and cutting off, as a well-marked division, the southern end of the Basin. In general, it has about the elevation of the highlands, and presents in its course but very few low gaps. It is the summit of the water-shed between the Duck and Elk Rivers. On its northern side Elk Ridge has but few spurs, and these are short. Its northern aspect faces the level or gently rolling regions of Maury, Marshall and Bedford, regions checkered with alternating cotton lands and cedar glades. On its southern side, however, it is different. Here, running out southerly toward Elk River and southwesterly toward Richland Creek for five, ten and twenty miles, are grand sprays of bold ridges, which have exceedingly rich slopes, and were covered originally with heavy forests. The valleys between the ridges, like the greater valleys of the two streams mentioned, are noted for the strength and fertility of their soils. The subdivision south of Elk Ridge embraces all of Giles, Lincoln and Moore Counties within the Basin, together with the southern end of Marshall. This whole region (not omitting the south and west sides respectively of the valleys of Elk River and Richland Creek) is remarkable for the multiplicity of its ridges and for its fertile and beautiful valleys, the latter often wide and open, supplying great bodies of first-class land.

Originally most of the area of the Basin was covered with cane, and even now this grows spontaneously in open woods when protected from cattle. Large oaks, poplar, sweet-gum, walnut, hickories, hackberry, black locust, honey locust, ash, elms, beech, sugar-maple, linden, dogwood and red-bud abound. The "cedar glades," a characteristic feature of the Basin, are areas more or less detached or scattered, upon which grow, or have grown, great cedar forests. They may be estimated to have covered in the aggregate 300 square miles. The soil of the glades is often black or dark colored, with a reddish-yellow subsoil, frequently thin, and much mixed with fragments of

thin, flaggy limestone, or the soil may be confined to the joint fissures (widened by erosion) of outcropping limestone in place, the bare rock making most of the surface. The true glades uniformly occur upon the outcrops of a particular bed of rock known as the "glade limestone," a thin-bedded, flaggy limestone with clay partings, having a maximum thickness of 120 feet, and belonging to the Trenton period. Where the soil is of sufficient depth the cedars grow tall, straight, and of great size for the species (*Juniperus Virginiana*), now and then reaching eighty or ninety feet in height, with a diameter of three or three and a half feet, and fair trees grow in soil among the loose rocks or in the earth of the fissures. Cedar timber standing in the woods has often been sold for \$100 per acre. The trade in cedar logs and lumber has been for many years, and is now, one of great interest in the Central Basin.

A great ring or belt of the cedar glades is found in Rutherford County. This belt incloses an oval area of red cotton lands, which is twenty-four miles long and twelve miles wide. The line of the Nashville & Chattanooga Railway lies nearly lengthwise across this oval, cutting the belt of glades on opposite sides. Murfreesboro is in the included area, a short distance east of the center. In Wilson County, and along Duck River in Bedford, Marshall and Maury Counties, are many glades, which cover large tracts. These occur also in Williamson and Davidson Counties. The glades very generally either surround or lie contiguous to one of two kinds of cotton lands, sometimes, indeed, lying between bodies of the two kinds. One of these is represented by the red soil of Rutherford. Both will be considered hereafter.

The soils of the Central Basin, and the earthy layer of *debris* upon which they rest, have been in the main derived from the decay and disintegration of underlying rocks in place. The chief exceptions are the alluvial soils, which, however, may not aggregate the thousandth part of the whole. Exceptions are also found in the case of certain steep slopes, where *debris* from above has been washed or otherwise brought down upon the lower lands; but the exceptions are inconsiderable, and may here be passed over. The rocks underlying and giving origin

to the soils (limestone of the Trenton period) are rich in fossil remains of plants and animals and in the materials of fertile soils. Locally, the strata appear to be horizontal or undulating; but complete sections across the Basin show that they rise or swell up in a great dome, the top of which is in the central region of Rutherford County. From this central region the strata have been removed by denudation, and the dome has been decapitated, thus exposing the lowest rocks (limestones) of the Basin. Here, then, the latter are to be seen and studied. Passing from this central area in any direction the approximately concentric belts of other outcropping limestones are successively encountered.

The limestones of the Basin have in the aggregate a thickness of 1,000 feet, but the strata differ in certain particulars. All have impurities; some have an excess of sandy, others of clayey material in their composition; some abound in flints or chert, or in organic remains; one is thick-bedded, another is thin-bedded; some disintegrate slowly, others rapidly. They are therefore grouped into subdivisions or kinds, each kind supplying a more or less characteristic soil. The kinds are enumerated below, beginning with the lowest, with notes:

(a) CENTRAL LIMESTONE DIVISION.

A series of limestones, 225 feet thick, chiefly heavy-bedded. They are light-blue or dove-colored rocks, fossiliferous, containing black or dark flints, especially the lower ones. The soil is a warm clay loam, brown when fresh, but becoming red (chocolate or copper-colored), like the subsoil, after several years' cultivation, and is known as a red soil. The subsoil is generally deep, and rests often upon a gray, clayey bed, the rock following below at depths varying from one foot to twenty feet, with an average depth of about ten feet. All the earthy matter above the limestone very generally contains fragments of decomposing flints. The soil and subsoil are mellowed by siliceous grains and gravel from this source, their color being derived from the iron of the flints. The native growth, representing well that of the entire Basin, indicates strong land, this red soil being one of the best in Middle Tennessee for the cult-

ure of cotton. Lands having it, which we may call the "central lands," occur chiefly in Rutherford, Bedford and Marshall, and to a limited extent in Wilson and Maury Counties, and generally lie well. The largest single body of such land is in Rutherford, and is the oval area inclosed in a belt of cedar glades already spoken of. Fine level areas, the lands alternating with cedar glades, are found throughout Marshall and in the north-westerly part of Bedford. The following analyses are given of samples of soils of the central limestones that were never in cultivation. The region from which they were taken is gently rolling, and where trees do not interfere a slight elevation is sufficient to give the eye a range over a great extent of country. The depth of soils in this region varies from nothing, on rocky spots, to fifteen or twenty feet, with an average depth of about ten feet (C. F. Vanderford). The red subsoil varies from two to five feet in thickness. Under this we have a bottom bed of a more plastic, light-yellow or gray clay, containing more or less angular, flinty gravel or decaying chert, often easily cut with the spade.

No. 1. *Red clay soil*, taken from a wood-lot near Florence Station, Nashville & Chattanooga Railroad, a little less than seven miles northwest of Murfreesboro, Rutherford County. Depth taken, seven inches; growth, species of hickory, red, white and post oaks, elms, ash, honey-locust, black walnut, wild cherry, sugar-trees, poplar, hackberry, red-bud, dogwood and papaw. Originally covered with cane.

No. 2. *Subsoil* of the above, taken at a depth of from seven to fifteen inches.

Nos. 3 and 4 are a *soil* and *subsoil* from near the same locality.

No. 7. *Red clay soil* from J. W. Burton's place, three miles north of Murfreesboro, Rutherford County, taken seven inches deep. The vegetation is about as that given above.

No. 8. *Subsoil* of the above, taken at a depth of seven to fifteen inches.

Red Clay Lands of the Central Basin, Rutherford County.

(135)

	SEVEN MILES NORTHWEST OF MURFREESBORO.				THREE MILES NORTH OF MURFREESBORO.			
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	No. 8.	
	No. 1.	No. 2.	No. 3.	No. 4.	No. 7.			
Insoluble matter-----	79.580 } 83.208 }	66.093 } 77.789 }	80.850 } 86.116 }	81.670 } 87.750 }	75.350 } 82.660 }	76.470 } 82.480 }		
Soluble silica-----	3.628 }	11.697 }	5.266 }	6.080 }	7.310 }	6.010 }		
Potash-----	0.150	0.508	0.140	0.211	0.255	0.251		
Soda-----	0.065	0.088	0.034	0.033	0.258	0.060		
Lime-----	3.054	0.119	0.510	0.161	0.340	0.142		
Magnesia-----	0.029	0.204	0.024	0.301	0.296	0.074		
Brown Oxide of Manganese-----	0.196	0.272	0.176	0.157	0.038	0.149		
Peroxide of iron-----	3.420	0.837	3.708	3.613	5.184	4.773		
Alumina-----	4.988	10.299	4.173	6.220	5.567	7.774		
Phosphoric acid-----	0.242	0.305	0.207	0.056	0.079	0.056		
Sulphuric acid-----	0.089	0.079	0.102	0.008	0.079	0.072		
Water and organic matter-----	4.962	3.728	4.784	1.966	4.962	4.230		
Total-----	100.402	100.228	99.973	100.476	99.718	100.051		
Hygroscopic moisture-----	8.64	8.84	7.23	5.59	7.29	7.93		
Absorbed at-----	23.9 C°	17.2 C°	23.9 C°	17.2 C°	22.2 C°	22.2 C°		

[In the foregoing analyses the first two soils (Nos. 1 and 3) resemble each other very strongly in every regard except their large lime percentages, which may be due in the case of No. 1 to some local circumstance, such as undecomposed particles of limestone, the country rock. Both soils may be considered as being fairly supplied with potash, and heavily so with phosphoric acid, and, in the presence of so much lime, should be exceedingly thrifty. There is, however, a great difference in their subsoils, soil No. 1 being supported by a heavy clay, rich in phosphoric acid, extremely so in potash, though having a small and insufficient amount of lime. Soil No. 3, on the other hand, rests upon a subsoil less clayey in character, containing a fair percentage of potash, but very deficient in phosphoric acid, an unusual thing for clay subsoils. The deficiency in lime in both subsoils is accompanied by increased percentages of magnesia, which, in the surface soils, is extraordinarily low. In volatile matter and hygroscopic moisture the difference between the two subsoils is due to their clayeyness, and throughout are satisfactory. The soil and subsoil from nearer Murfreesboro both fall very short in their percentages of phosphoric acid, though they are fairly supplied with other necessary constituents.—*E. W. H.*]

(b) CEDAR GLADE LANDS.

Next above the central limestones follow the thin-bedded flaggy limestones, making the *cedar glades* already spoken of. The soils of this division have been noticed. Where these are deep enough, and the cedar stumps and loose flags permit it, the land in the middle and southern portion of the Basin is often cultivated in cotton. In general, however, comparatively little of it is produced upon the areas of the "glade limestones."

(c) CARTER'S CREEK LIMESTONE LANDS.

Resting upon the flaggy limestones next comes a heavy-bedded rock, which, owing to its conspicuous outcrops on Carter's Creek, in Maury County, I have called the *Carter's Creek limestone*. It is also known as the *Woodbury limestone*, this county town being built upon it. The rock is light-blue in color, con-

taining siliceous fossils and more or less chert, and is in all nearly 100 feet in thickness. Where the surface lies well, and is level or gently rolling or sloping, this rock often supplies a good agricultural country. Areas underlaid by it occur in all the counties within the Basin, and it underlies much of the surface outside of the "cedar glades" in the counties of Wilson, Rutherford, Bedford, Marshall, Maury and Williamson. Excepting a few limited and unimportant spots, it is the lowest rock appearing at the surface in Smith, Trousdale, Sumner, Davidson, DeKalb, Cannon, Lincoln and Giles Counties. The soil above it is, when fresh, brown or dark; the subsoil is yellowish or reddish-yellow, rather clayey, and contains gravelly chert. It has not the markedly red color of the subsoils and warm soils of the central limestones. In the main, the lands of the Carter's Creek limestones, as compared with the central limestones, are second class. They do not generally lie so well, are often hilly, and are more frequently broken by rough, rocky places ("rocky roughs"), upon some of which cedars grow, making outliers of the true glades. Yet there are many sections where, topography being equal, they are little inferior to the central lands in tilling qualities and fertility. Both kinds of lands are often confounded with the true glade lands, all being designated "cedar lands." This is due to the fact that the central and Carter's Creek areas adjoin the glades, the first concentrically within and the second without, or are locally and irregularly interlocked with them. A considerable proportion of the best of them, commencing with Wilson County and going southward, are cultivated in cotton with good results.

(d) ORTHIS LIMESTONE LANDS.

A series of sandy limestones from seventy to one hundred feet in thickness, which we shall call the *Orthis bed*, follows in ascending order. In certain sections of the Basin, as about Nashville, the upper portion of this series is a remarkably laminated current-formed rock of about twenty-five feet in thickness, made up in general of comminuted shells or "shell sand." The grains are generally calcareous, but are much mixed with siliceous grains. This portion has been named the *Capitol lime-*

stone, as it supplied the stone for the Capitol at Nashville. The lower and much the greater portion, as well as the persistent portion (being found in its geological horizon throughout the Basin), is the *Orthis bed proper*, so named because at most points it is well filled with individuals of a fossil shell, having about the diameter of a dime, known to geologists as *Orthis testudinaria*. The bed is, in general, a sandy or siliceous, often shaly, calcareous rock, and when freshly quarried is light blue in color; but upon thorough weathering it becomes a yellowish, sandy shale or a porous sandstone, and blocks of the latter are often met with on slopes. Sometimes these blocks, when broken, show a blue, unchanged nucleus within. The usual thickness is from fifty to seventy-five feet. In the eastern part of Williamson County, however, as about Triune, there is a local thickening of the bed, it becoming 150 feet thick or more. Owing to its sandy or siliceous nature, the rock has a degree of weather-resisting power, and hence contributes local plateaus and terrace and level lands to the topography of the Basin. These local features are best seen west of the central areas of the Basin in Wilson, Sumner, Davidson, Williamson and Maury Counties, and include some of the fairest and best farming tracts in Middle Tennessee. The soil, when first cultivated, is a rich brown loam, with a subsoil usually yellow, but sometimes reddish-yellow. The latter also is often made more or less gravelly by thin, sandy fragments, the *debris* of the disintegrated rocks. This soil is mellow, warm, well drained and easily cultivated—characteristics which make it a favorite cotton soil—and its areas are generally known as poplar lands, the so-called “poplar” (*Liriodendron*) being, or having been, a very characteristic tree of its forests. Its growth, besides poplar, includes beech in places, especially on the slopes and in the heads of hollows, ash, sugar-tree, oaks, elms, dogwood, hickories, hackberry, black walnut, linden, box-elder, and other species, the variety being remarkably great. It must be stated, however, that the lands of this bed are not uniformly good, for tracts occur, especially on the slopes and ridges, where the soil has been washed or leached, or otherwise impoverished, and the lands reduced to third rate, supporting an uninviting native growth. In cultivated fields in rolling or hilly regions, especi-

ally if old, it is no uncommon thing to see naked, badly washed, and "scalded" places with soil all gone, spotting at intervals along the slopes the horizontal line of the outcrop of the bed. These bare places are made so by careless cultivation and inattention.

The following analyses are given of lands of this region; the samples being obtained from localities lying well, and among the best and most beautiful agricultural sections of the State:

No. 11. "*Poplar*" land soil from Vanleer Polk's place, Maury County. Depth taken, eleven inches; timber growth, "*poplar*," sweet-gum, walnut, oak, ash, elm, hackberry, honey-locust and dogwood. Originally covered with cane.

No. 12. *Subsoil* of the above, taken at a depth of from eleven to twenty-three inches.

No. 13. "*Poplar*" land soil from the Hermitage, Davidson County. Depth taken, ten inches; timber growth about the same as that of soil No. 11.

No. 14. *Subsoil* of the above, taken at a depth of from ten to twenty-two inches.

Poplar Lands of the Central Basin.

	MAURY COUNTY.		DAVIDSON COUNTY.	
	Vanleer Polk's Place.		Hermitage.	
	Soil.	Subsoil.	Soil.	Subsoil.
	No. 11.	No. 12.	No. 13.	No. 14.
Insoluble matter.....	79.370 } 84.742	78.840 } 81.871	78.860 } 85.780	75.100 } 84.080
Soluble.....	5.472	8.581	6.900	8.930
Potash.....	0.319	0.337	0.238	0.584
Soda.....	0.069	0.080	0.047	0.114
Lime.....	0.815	0.547	0.378	0.465
Magnesia.....	0.342	0.358	0.368	0.444
Brown oxide of manganese.....	0.040	0.088	0.093	0.054
Peroxide of iron.....	3.683	5.285	2.627	3.693
Alumina.....	5.294	7.120	6.098	6.979
Phosphoric acid.....	0.349	0.342	0.255	0.318
Sulphuric acid.....	0.193	0.107	0.085	0.056
Water and organic matter.....	4.549	3.372	4.498	2.483
Total.....	100.084	99.497	100.415	99.223
Hygroscopic moisture.....	8.62	11.48	10.02	10.00
Absorbed at.....	29° C.	29° C.	26.2 C.	26.2 C.

[The common and prominent characteristics of all these popular soils is a very unusually high percentage of phosphoric acid accompanied by a large supply of lime—two prime conditions of thriftiness and durability. The supply of potash also is ample, and with a high hygroscopic power and easy tillage shows them to be altogether excellent soils.—*E. W. H.*]

(c) MULATTO LANDS OF THE NASHVILLE SERIES.

In this subdivision we include all the remaining Silurian limestones above the *Orthis* bed. The series in the northern part of the Basin is from 400 to 500 feet in thickness, but in the southern and southwestern part its thickness is much reduced. Here, too, its lowest layers often contribute to the top-most of the *Orthis* bed in making the underlying rock of many nearly level and superior agricultural tracts. It is in the main a sandy or earthy highly fossiliferous limestone, containing in its composition all the inorganic and some of the organic elements of exceedingly fertile and mellow soils. It is named, by way of distinction, the *Nashville series*, being well displayed about the city, especially on the higher grounds. The area of the outcrop of these rocks, and hence the area of the soils derived from them, sweeps around the basin in a ring or circular belt outside of the concentric outcrops and soils of the limestones already mentioned. This ring is much the wider on the western and southern sides, and supplies large and valuable tracts of land in the counties of Trousdale, Sumner, Davidson, Williamson, Maury, Giles, Lincoln and Moore. The surface is in places level or gently rolling; then it becomes hilly, especially as we go westward toward the limit of the Basin. On the eastern side, in Smith, DeKalb, the southeastern part of Wilson, Cannon, the southern part of Rutherford, and the eastern part of Bedford, the ring is not so wide. Here, however, numerous beautiful valleys and tracts occur, many of which, as we approach the eastern side of the Basin, are separated by high ridges with exceedingly rich and fertile slopes. In fact, the sides of the Basin all around are fringed with bold spurs, whose limestone slopes have unsurpassed fertility of soil. With these may be included the slopes of such high knobs and

ridges as exist within the Basin. Of the latter, Elk Ridge, already spoken of, with its northern face and declivities in the southern parts of Maury, Marshall and Bedford, and its southern ramifications in Giles, Lincoln and Moore, is a noted example. Altogether, the aggregate area of the lands of the Nashville series must be one-half or more of the entire area of the Basin. The soils are mulatto-colored loams with yellow subsoils, the latter tempered with cherty gravel and siliceous remains of fossils. Approaching the spurs and ridges, we often find the soils and subsoils of the slopes much mixed with gravelly *debris* that has been washed down or otherwise brought down from the siliceous subcarboniferous rocks that cap these jetting arms of the highlands. The growth presents a rich flora, including many species, among which may be mentioned great burr or overcup oaks, elms, ash, hickories, linden, black walnut, cucumber-tree, mulberry, cherry and, on hill sides, yellow wood, coffee-trees, butternut, and black locusts. Excepting in the more southern counties of the Basin, the soils of the series are not considered as among the best for cotton, as the plant grows too luxuriantly, and does not mature in season. In Giles and Lincoln, however, they are, with the creek and river bottoms, chiefly relied upon for the production of cotton. In the southern part of Marshall, and in some parts of Maury and Williamson also, a good share of their areas is devoted to cotton culture. The following analyses are given of samples of this land:

No. 9. *Mulatto clay soil* from Belle Meade, a few miles west of Nashville, Davidson County. Depth taken, eight inches; timber growth, oaks, elm, hickory, ash, linden, sugar-maple, hornbeam, walnut, cherry, dogwood and red-bud. Originally with an undergrowth of cane.

No. 10. *Subsoil* of the above. Depth taken, eight to twenty inches.

No. 6. *Subsoil* from near the above. Depth taken, eight to twenty inches.

Mulatto Clay Lands of Nashville, Davidson County.

	Soil.	Subsoil.	Subsoil.
	No. 9.	No. 10.	No. 6.
Insoluble matter -----	56.540 } 65.380	47.950 } 58.960	54.932 } 65.472
Soluble silica -----	8.840 }	11.010 }	10.540 }
Potash -----	0.468	0.752	0.242
Soda -----	0.108	0.174	0.054
Lime -----	6.540	8.382	3.015
Magnesia -----	0.569	0.615	0.675
Brown oxide of manganese -----	0.187	0.091	0.152
Peroxide of iron -----	7.286	9.584	9.761
Alumina -----	12.419	17.303	16.272
Phosphoric acid -----	0.563	0.355	0.175
Sulphuric acid -----	0.156	0.188	0.119
Water and organic matter -----	6.318	3.591	4.208
Total -----	99.994	99.995	100.145
Humus -----	1.676		
Available phosphoric acid -----	0.179		
Hygroscopic moisture -----	10.55	11.01	9.70
Absorbed at -----	26.6 C. ^o	26.6 C. ^o	17.8 C. ^o

[The extraordinary percentage of phosphoric acid in soil No. 9 and its subsoil (the former exceeding all others heretofore analyzed), together with the unusual predominance of lime and large supply of potash, shows sufficient cause for the high estimate placed upon their productiveness, and gives promise of almost indefinite durability.—*E. W. H.*]

The following mechanical analysis has been made of the mulatto clay subsoil No. 10, of Belle Meade, near Nashville, by M. E. Jaffa, of the University of California:

	Per cent.
Clay -----	27.930
Sediment of less than 0.25mm by hydraulic value -----	29.203
Sediment of less than 0.25mm by hydraulic value -----	4.315
Sediment of less than 0.50mm by hydraulic value -----	6.799
Sediment of less than 1.00mm by hydraulic value -----	5.802
Sediment of less than 2.00mm by hydraulic value -----	3.390
Sediment of less than 4.00mm by hydraulic value -----	2.994
Sediment of less than 8.00mm by hydraulic value -----	6.967
Sediment of less than 16.00mm by hydraulic value -----	3.936
Sediment of less than 32.00mm by hydraulic value -----	5.096
Sediment of less than 64.00mm by hydraulic value -----	0.495
Total -----	96.927

SIXTH—THE CUMBERLAND TABLE-LAND.

Leaving the Central Basin, and crossing the eastern division of the Highland Rim, we reach the foot of the western escarpment of the Cumberland Table-land, an elevated and sharply outlined division of the State. This is usually called Cumberland Mountain, but it is better designated as the Table-land. It is, as already said, a plateau with a broad and generally level top, standing in bold relief above the lowlands on each side, the Rim lands on the west and the East Tennessee Valley lands on the east, rising up, in round numbers, 1,000 feet above these, and 2,000 feet above the sea. It is the Tennessee coal field, and embraces an area of 5,100 square miles—about one-eighth of the State. Within its limits are included Scott, Morgan and Cumberland Counties, and the greater parts, severally, of Fentress, Van Buren, Grundy, Bledsoe, Sequatchie and Marion, with considerable portions of Overton, Putnam, White, Warren, Coffee and Franklin on the West, and of Claiborne, Campbell, Anderson, Rhea and Hamilton on the east. The western edge of the division is notched and scalloped by deep coves and valleys, which are separated by finger-like spurs pointing westward, while its eastern edge is a nearly direct or gracefully curving line. At almost all points, on both sides, the surface suddenly breaks off in sandstone cliffs from 20 to 200 feet in height, giving everywhere a sharp and prominent margin or brow to the division. Commencing in the very body of the division, near the middle of the State, and extending southwestward into Alabama, the Table-land is completely split longitudinally in two by the deep Sequatchie Valley, a narrow, straight trough, sixty miles long, and averaging not more than four miles in width, if as much. Of the two arms thus formed, that to the west of the valley mentioned retains the name Cumberland, while that to the east is known as Walden's Ridge.

The surface of the Table-land is often flat for miles, with an open growth, mostly of oaks; then again it is rolling and diversified with hills and shallow valleys. In the northeastern part are high ridges, which may be regarded as mountains on the Table-land. The division is very generally capped with sandstone, and shales are sometimes met with. The soils are

thin, sandy and porous, and are decidedly poor as compared with the limestone regions we have considered. In some sections they afford a pasturage of wild grasses. Apples and grapes often do well, and so do garden vegetables and Irish potatoes with plenty of manure. Here and there, on slopes at the foot of knobs or ridges and along streams, more fertile areas are found, where land is cultivated; but in the aggregate farming operations on the Table-land amount to very little. In general, the population is sparse, and wide regions without an inhabitant are traversed. The mountain, however, has attractions outside of its agricultural features which have drawn to certain localities many enterprising men, resulting in the building up of towns and intelligent communities. A very great accession is the establishment of the University of the South at Sewanee.

We pass now from the sandy top of the Table-land to the rich limestone declivities which make its sides. Below the great cap of the mountain—a cap made up of sandstones, shales and coal-beds interstratified—there is everywhere a great limestone bed, known as “mountain limestone,” whose strata outcrop on all sides. The outcrops along the western side or slopes, which have more agricultural importance than the eastern, make at least two-thirds of the ascent from the base up. The surface is generally rocky, with very little soil. At intervals, however, bodies of land are met with which are rich and fertile. Not much of this land has been brought into cultivation, but now and then a small farm or field shows itself as an open spot among the trees on the face of the ascent as one travels the lowland roads parallel with the mountain. The slopes are, in the main, covered with heavy forests, the trees, often of large size—poplar, black and white walnut, white oak, linden, mulberry, hackberry, species of ash, cherry-tree, together with the cucumber-tree, the great-leaf magnolia, papaw, and others—making a rich forest flora.

North of McMinnville a bench or terrace is very generally to be seen running along the slopes of the Table-land and about half-way up. This comes from a thin sandstone, which in this region is interpolated in the series of mountain limestones.

Immediately west of the main mountain and its outliers are many flat-topped ridges and "little mountains," which have the same height as the benches and are capped with the same sandstone. The flat summits of all these have a rich, mellow soil, often sandy, upon which corn and wheat grow luxuriantly, and present favorite areas for orchards. Cotton, which is now occasionally seen in "patches," would, in a more southern climate, do well upon them. We add, that at the foot of the main mountain, as well as around the outliers, there is often much good land. This is especially true of the coves, some of which are noted for rich and beautiful farming areas. Going westward, these soils soon run into the red clay soils of the Highland Rim; in fact, they, as well as the soils of the steep mountain slopes, might have been considered consecutively after the red soils of the Rim, since their underlying limestones belong to the same group, the Subcarboniferous. In the southern part of the State cotton was formerly cultivated to a considerable extent in the coves and elsewhere along the base of the mountain, but now but little of it is raised.

SEVENTH—THE VALLEY OF EAST TENNESSEE.

Passing in our course eastward the Cumberland Table-land, with its flat areas, oak woods, and sandy soils, we find ourselves in the great and populous Valley of East Tennessee, with its diversified rocks, soil and scenery.* This division has been briefly characterized on a former page. Within it is embraced nearly all the agricultural wealth which is usually accredited to the civil division we call East Tennessee. Its area extends through the State from Virginia to Georgia, and is included between the Cumberland Table-land on the west and the Unaka Mountains on the east or southeast, its lateral limit being clearly

* It may be noted that the Cumberland Table-land, rising so boldly above the general level of the State, separates two of the great sections of Tennessee—sections great in area, wealth and population: the Central Basin, with the best of the Rim uplands around it, on the west, and the Valley of East Tennessee on the east. The comparatively barren Table-land has always been a serious obstacle in the way of free intercourse between these sections. Even now no railroad crosses it within the State. To pass from Nashville to Knoxville, it is necessary to make a great detour to the south through Alabama.

defined by these mountains.† It includes the following counties and parts of counties: The whole of James, Bradley, McMinn, Meigs, Loudon, Roane, Knox, Jefferson, Union, Grainger, Hamblen, Hancock, Hawkins, Washington and Sullivan, parts of Marion, Sequatchie, Bledsoe, Hamilton, Rhea, Anderson, Campbell and Claiborne (the other parts of these being on the Table-land) and parts of Polk, Monroe, Blount, Sevier, Cocke, Greene, Unicoi, Carter and Johnson (the remaining portions of the latter making up the area of the Unakas). Measured directly across in the northern part of the State, the area is fifty-five miles wide or thereabout. Toward the south the mountain barriers approach each other, and the width is reduced approximately to thirty-four miles, not including the outlier, Sequatchie Valley. As seen from the high points of the Unaka Mountains, the Valley of East Tennessee presents a wide-spreading floor—a vast, nearly level plain, limited on the west in the distance by the wall-like eastern escarpment of the Cumberland, and having but a few isolated ridges, like long, narrow islands, projecting above the general surface. But when we descend from the mountains and travel across this floor it is anything but a level plain, the whole becoming an area fluted with a multitude of smaller valleys and ridges—a furrowed field on a Titanic scale. The valleys and ridges are crowded together, and extend in parallel lines to the northeast and southwest, the prevailing directions in the Valley of East Tennessee. The smaller streams take, in the main, either the one or the other course. The rivers flow to the southwest, or, in the case of those from North Carolina, make their way across the country by the shortest routes through gaps and breaks of the ridges to those that flow to the southwest. The railroads and other chief lines of travel and commerce run with the valleys. This northeasterly and southwesterly striation, if I may use the word, of the great Valley, so far as its natural and many of its artificial characteristics are

† I include in this division, as outliers, the interesting valleys and coves, which are more or less interlocked with the ridges of the mountains on each side. One of these, Sequatchie Valley, splitting the southern portion of the Table-land, has been spoken of. On the eastern side there are many, some of them noted for the attractiveness of their natural features. The cultivated part of one county (Johnson) in the northeastern part of the State, is a mountain-hemmed cove, with no way of getting in or out except by scaling mountains or by passing through dark and rocky water-gaps. Other interesting coves are Wear's, in Sevier County, and Tuckaleechee and Cade's, in Blount County.

concerned, is strikingly seen on the geological and topographical as well as agricultural maps of the State. This is all due primarily to the fact that the rocky strata are greatly inclined or tilted, so that their edges outcrop along the surface, which they do in northeasterly and southwesterly lines. Thus the rocks present themselves at the surface in long, narrow, parallel strips or belts with the trend indicated. The hard, strata-like sandstones and cherty dolomites make the ridges; the soft, like limestones and shales, the valleys. The several soils of the valleys and ridges necessarily occur in strips. Some of the valleys or valley ranges, though averaging hardly a mile in width, may be traced, or indeed traveled in, from Virginia to Georgia, a distance of 150 miles, to say nothing of their extension either way beyond the limits of the State. Certain ridges, straight or slightly curving, are equally long, and most of them may be followed for scores of miles. Some ridges are narrow and sharp, like a steep roof; others are wide, broadly rounded on top, and of far greater importance, of which Copper, Chestnut and Missionary Ridges are types. These are dolomite ridges, and their surfaces are strewn with cherty masses and gravel. The ridge upon which Knoxville is built is one of the latter, a range originating in the northern part of Knox County and traceable into the State of Georgia. Ridges of this type occasionally flatten out, giving us plateau areas of great agricultural value, such, for example, as the body of land traversed by the East Tennessee and Virginia Railroad in Jefferson and Hamblen Counties, or break up more or less into wide belts of cherty knobs, as those in Hamilton and Rhea, between the Tennessee River and the Cincinnati Railroad, or those in Hamilton and James east of Missionary Ridge, and crossed by the Chattanooga and Cleveland Railroad. But these cherty dolomite knobs are not the only ones. The kinds of knobs characterizing the two areas are designated respectively as the "red belt" and the "gray belt," and differ in a degree from each other. The *red belt* begins in Jefferson County, has its greatest width in Knox and Blount, and continues southwestward through other counties to the Georgia State line. This area is remarkable for its long lines of red knobs and red lands. With the lines of knobs are intervening broken valleys. The soils

are based upon calcareous shales, with which are interstratified very ferruginous sandy limestones, flaggy limestones, and red marbles. They are often very mellow and fertile, as upon the slopes of the knobs. The *gray belt*, so named from the prevalence of gray lands and earthy gray rocks, lies farther to the eastward. It is a great club-shaped area commencing on the Virginia line and extending southwestward to the Hiwassee River, reaching, indeed, nearly through the State. Its characteristic feature is found in its isolated and often crowded knobs, which beset the surface like monster ant-hills. Many portions of the belt are spoken of locally as "the knobs." These are conical hills of all heights, from 100 to 500 feet, and sometimes they are more or less elongated, forming short ridges; and in some regions where closely set, they make a wild country traversed by narrow labyrinthine valleys. The formation of the area is a heavy body of sky-blue, calcareous, and often sandy shales, weathering to yellowish gray, or buff, and contain occasionally thin flaggy limestones, and at some points thin sandstones. The belt often possesses a dark rich soil, supporting a growth of white oak, poplar and hickory, and some portions abound in small farms between the knobs and on their slopes. In such regions we have what has been called "the poor man's rich land."

If we draw a line from Virginia to Georgia lengthwise through the middle of the great Valley, splitting it into halves, the knobby belts we have just described will lie in the eastern or southeastern half. Besides these, there are in this part many ridges and valleys based on other rocks. It is, however, in the other half of the Valley, on the northwestern side of the median line, that we have the most characteristic display of the wonderfully long, yet narrow, parallel, and alternating valleys and ridges. The length of these has already been referred to. I add a word more as to the valleys. These are troughs between the ridges, and are narrow or wide in proportion to the separation of the latter. They vary in width from the fraction of a mile to one mile or two miles, not often more than this, and most of them are attractive and fertile. Some of the narrow ones are cold and unproductive. There are two principal classes, as will be hereafter noticed, the limestone valleys and

the shale valleys, and both kinds in general are amply watered by streams abundantly supplied with free-flowing springs, well populated, abounding in arable fields. Each valley is a kingdom in itself, communities being separated from each other by the intervening ridges. Most of the population live in the valleys, though houses and farms are occasionally seen upon some of the ridges of the Copper Ridge type. For the most part, the ridges are the wooded portions of the country. Seen from a distance, they are marked out by lines of forests crowning the summits, which heighten the contrast between ridge and valley. The fields of the valleys often creep a long way up the slopes to the line of the trees.

For present purposes enough has been said as to the general character of the Valley of East Tennessee. To go into detail, enumerating and describing all its numerous and varied features of structure and surface, would carry us far beyond reasonable limits.*

The Valley belongs at most to the *penumbral region* of cotton culture. The whole yield reported for the census year, including also the little cotton raised in the mountain parts of such of its counties as reach out, respectively, upon the Table-land and the Unakas, is only 537 bales, and of this more than 400 bales were raised in the valley portions of counties south of the latitude of Knoxville. In nearly all the counties, quarter-acre or half-acre patches are occasionally met with, in which a little cotton is cultivated for home use.

The "*limestone lands of certain valleys in East Tennessee*" make some of the best agricultural belts of the division. They have blue limestone soils, the equivalents of the soils in the Central Basin, and nearly all the important valley ranges on the western or northwestern side of the median line of the division have these soils. Such are the valleys known as Powell's, Beaver Creek, Raccoon, Hickory, Savannah and others. They make the long valley ranges to which attention has been called, and are everywhere in cultivation and dotted with farm-houses.

* For further information as to the physical and agricultural features of this division, see the writer's *Geology of Tennessee*.

Toward the south, and before reaching the Georgia line, most of these valleys are pinched out, giving way to shale valley ranges or to ridges. On the east or southeast side of the median line there are very few of these, and they are unimportant.

The "*calcareous shale and valley lands*" belong to a group of valleys equal in importance to those just mentioned. The rocks which supply the soils are variegated, chestnut-colored, greenish and buff shales, generally calcareous, and show now and then an interstratified layer of dolomite or limestone. This series is called *Knox shale*. Many of the valleys are very desirable agricultural belts. In the southern part of the division especially a number of them are wide, gently rolling or level, and afford tracts of highly fertile land, often in a good state of cultivation. It is one of the important soils upon which cotton is cultivated. The soils are clayey, but are mellowed by the *debris* of thin sandy layers and by calcareous matter. On the west side of the median line the shale valleys, or valley ranges, when followed northeastward up the country, become very much narrowed, losing their importance. This is also the case to some extent on the eastern side of the valley.

The "*magnesian limestone lands*" are those of level or rolling plateau belts, or of moderate slopes based on dolomites, and such as that above mentioned traversed by the railroad in Jefferson and Hamblen Counties. There are but few of these areas, and these are chiefly in the upper end of the Valley. These soils are strong and fertile, and under cultivation. The subsoils are deep yellowish or reddish, and contain cherty gravel and masses of chert. These areas I have spoken of as dolomite ridges flattened out into the plateau land.

The "*ridge and cherty lands*" are those of many wide and rounded dolomite ridges in the Valley, of which Copper, Chestnut and Missionary Ridges, before mentioned, are good examples. In these the rocky strata are usually concealed by a great depth of clayey, reddish subsoil, in which there is much chert and cherty gravel intermixed. The surface of the ridges is often so covered with flinty gravel as to supply natural macadam road-beds, over which it is pleasant to drive. The wooded

summits, the encroachments of the cultivated fields upon the slopes, and the presence occasionally of houses and farms upon the ridges, have been referred to. In regard to alluvial lands, bottoms occur at intervals along the streams, there being noted ones on the French Broad, the Holston, Tennessee and other rivers. The aggregate of such land, however, though very considerable, is limited in this division as compared with what we have in the western part of the State.

Sequatchie Valley is the most important outlier of the Valley of East Tennessee. Its relation to the Cumberland Table-land or Mountain has been given. As stated, it is a narrow, straight trough, sixty miles long, with an average width of not more than four miles, and lies compressed between the two arms of the Table-land, the steep and opposing walls of which rise on both sides to an elevation of 1,000 feet and overshadow the area below. Looking from these heights down upon the valley, we see first a central, depressed, wide and wooded ridge, running as far as the eye can reach lengthwise through the valley, and constituting the greater part of its surface, and then two cultivated valleys, one on each side of the ridge, between it and the foot of the mountain slopes. The rocks of the central ridge are dolomites, like those of Copper and Chestnut Ridges in the main Valley to the east, to which class of ridges it belongs, the cherty lands, native growth, etc., being similar. The Valleys have strong soils based on blue limestones, and give a large aggregate of good farming lands. That on the eastern side, in its rocks and soils, is to be referred to the class of valleys, including Powell's, Beaver Creek, Raccoon and others, before mentioned. That on the west side has frequently more cherty limestones (Mountain or St. Louis) for its underlying rocks. The Tennessee River, breaking through the eastern arm of the Mountain, enters the southern end of Sequatchie Valley, and then flows in the extended course of the latter far into Alabama. Sequatchie River runs through the whole length of the valley, winding along for the most part, very curiously, in the ridge area, breaking up the latter here and there into hills and knobs.

But three reports have been received from counties in the Valley of East Tennessee, abstracts of which have heretofore

been given. As to the first it may be noted that Chickamauga is near the Georgia line. Dolomite cherty ranges, as well as a valley of the Knox shales, pass through this region.

EIGHTH—THE UNAKA MOUNTAIN REGION.

We have now reached the last of the eight natural divisions of Tennessee, the *Unaka Mountain Region*. The general character of the division, its position, elevation and area, have been briefly given. It embraces the mountainous parts of Polk, Monroe, Blount, Sevier, Cocke, Greene, Unicoi, Carter and Johnson Counties. Including interlocked valleys and coves, the region is a long belt, with a width of about thirteen miles, lying contiguous to the State of North Carolina, and reaching from Virginia to Georgia. It gives to the eastern end of Tennessee a greatly raised, cloud-capped border, strikingly in contrast with the low and often flooded plains of the western end. The included valleys and coves having been referred to and treated as outliers of the division last described, we are concerned here mainly with the mountains proper. The great ridges embraced in the division, and often named the Unakas, are arranged approximately in two principal chains, which are more or less crowded together in parallel lines. The chains are not continuous. The main one, the axis of the group (of which Catface Mountain, the Yellow, the Roan, the various "Balds," the Great Smoky and the Frog are some of the prominent points), is cut directly across by rivers, seven in number, which flow from the western slope of the Blue Ridge in North Carolina northward into Tennessee, passing the great axis in deep and magnificent water-gaps. The most westerly chain of less average height (to which belong Star's, Chilhowee, English's, Meadow Creek, Holston, and other mountains), was elevated by the original geological forces in detached ridges, often many miles apart, but arranged lengthwise, and facing end. Nevertheless, some of the isolated mountains—Star's and Chilhowee, for example—are cut in two by water-gaps. The portion of the main axis between the French Broad and Little Tennessee presents in its length of sixty-five miles a series of peaks but a few feet lower than the highest of the Black Mountains in North Carolina.

Many of these exceed 6,000 feet. Altogether, we have here, without exception, the boldest and greatest mountain mass to be found anywhere east of the Mississippi river, known as the Great Smoky. Farther to the northeast, in the section between the Watauga and Nolichucky, are several great ridges, among which we may mention the Roan. This, though not having the highest peaks, is in some respects the grandest mountain of the Unakas. Its summit, presenting a number of peaks more than 6,000 feet high, is in many places destitute of trees, owing to the low temperature of the heights. These are called "balds." On the Roan there is a succession of them, giving the broad summit at intervals a meadow-like aspect. Such places we have seen in the summer time alive with stock of all kinds, feeding and fattening upon the rich herbage. The "balds" are not confined to the Roan, but occur at many points along the summits of the main Unakas. As a rule, the ridges are clothed with forests. When, however, a height of about 5,000 feet above tide is reached, the deciduous trees—beeches, oaks and maples—become more or less dwarfed, and often in ascending farther entirely disappear, the summit then becoming a "bald." Some of the highest points, instead of being bald, are dark with a heavy balsam and evergreen growth.

The rocks of the Unakas are micaceous and hornblendic gneisses, granites, slates, semi-metamorphic conglomerates, and sandstones, the strata of which are upturned and dip at high angles. The ridges are cold, steep and rocky, and, in the main, have thin, sandy soils. Nevertheless, on the tops of the highest ridges are tracts, like those of the "balds," prairie-like, black and rich. Places of considerable fertility are rarely met with on wooded slopes supporting a growth of walnut, beech, poplar, wild cherry, and the like, but at long intervals a cleared spot may be discerned. The mountains proper can hardly be said to be inhabited, and it is rare to meet with a true mountaineer. The chief settlements are below in the valleys and coves. Occasionally, cabins and small cultivated fields may be found along a stream in a depression of the high mountains. But we have already dwelt longer than necessary upon the characteristics of this division. As a section for the growing of cotton it has no interest. Of that reported as the product

of certain counties partly pertaining to the division, perhaps not as much as a bale was raised upon the Unaka ridges proper. The mountains, so far as utilized, have been in the main grazing grounds for cattle.

REMARKS ON COTTON ACREAGE AND PRODUCTION IN TENNESSEE.

The cotton-producing areas of Tennessee lie substantially in the western half of the State. There are two chief regions of production, the one mostly within the great Plateau Slope of West Tennessee and the other in the Central Basin. These regions are united by an area of low production lying within the limits of the highlands, in the western part of Middle Tennessee. The western region is the much more important of the two. Its area of greatest acreage in cotton, and the greatest occurring in Tennessee (15 per cent. and above), lies in the southwestern corner of the State. Passing from this outward, northerly to Kentucky, or easterly toward the highlands before referred to, areas of less and less acreage are successively crossed. The eastern chief region, that in the Basin, has no one center of greatest acreage. The highest reached is 10 to 15 per cent., and this is found in detached belts or sections in different parts of the Basin, inclosed by areas of lower acreage. We add that as in going northward the cotton product diminishes, the tobacco product, in general, takes its place and increases.

It is to be noted that the northern edge of the cotton-producing portion of Tennessee and of a small strip of Western Kentucky between the Mississippi and Tennessee Rivers, is, for the inland section east of the Mississippi River, the extreme northern limit of the cotton region of the South.*

The chief circumstance which determines this limit is the low temperature of the climate, or, as we may put it, the shortness of the growing season; that is to say, the season between frosts.

*We do not regard the penumbral regions of cotton culture in Tennessee and Kentucky. What we find there only proves that under unusually favorable circumstances, or in special cases, cotton may be cultivated out of its proper domain, within which only fair and constant mean results are attainable.

This matter has already been discussed. It has been shown that the isotherms, or lines of equal heat, of spring and fall for the non-mountainous parts extend diagonally through the State, or, say, parallel to a line running from its southeastern to its northwestern corner. In accordance therewith, the limit of the cotton region, as seen in Tennessee and Kentucky, is approximately parallel to such a line, or would be, excepting that at one point the exceptionally warm and mellow lands of the Central Basin prevail and carry the limit beyond the normal line. And further, in harmony with the direction of the isotherms, the extreme southwestern corner of the State is the warmest and has the longest growing season, and here we have the area of greatest production. Cultivators of cotton in all parts of the State, even in the warmest portion just referred to, fear the late frosts of spring and the first killing frosts of autumn, and are often driven from the rich, but colder, alluvial bottoms to the warmer, early-maturing uplands.

TABLE I.—Population and Cotton Production in each Agricultural Region in the State.

AGRICULTURAL REGIONS ARRANGED ACCORDING TO PRODUCT PER ACRE.	Land Area. Sq. Miles.	POPULATION.			COTTON PRODUCTION.									
		Total.	White.	Colored.	Acre.	Bales.	Product per Acre.			Total in Tons.		Percentage of State's Total Production.	Cotton Average per Square Mile.	Bales per Square Miles
							Bales.	Seed Cotton.	Lint.	Seed.	Lint.			
The State.....	41,750	1,542,859	1,138,831	408,828	722,562	330,621	0.46	651	217	434	78,522	157,044	100.0	7.9
Lake County (Mississippi River alluvium).....	270	8,968	8,274	694	3,249	2,412	0.74	1,059	353	706	578	1,146	0.7	11.4
Mississippi River alluvial and Bluff region.....	2,540	152,411	84,118	68,293	177,028	93,842	0.53	758	252	504	22,287	44,574	28.4	36.9
Western Valley Table-lands ^e	6,200	281,997	162,278	99,719	369,269	171,594	0.44	621	207	414	40,739	81,478	51.9	27.7
Western Valley Tennessee River.....	2,910	68,609	158,935	8,574	24,033	9,620	0.40	570	190	380	2,283	4,570	2.9	3.3
Highland Rim.....	8,200	225,928	185,948	39,980	9,700	3,843	0.41	682	194	388	913	1,826	1.2	0.5
Central Basin.....	6,190	397,151	292,461	104,690	120,729	48,578	0.40	576	192	384	11,595	23,170	14.7	7.5
Cumberland Table-land†.....	2,970	29,181	27,966	1,215	138	55	0.41	598	196	392	18	36	.....	.....
East Tennessee.....	12,530	413,214	368,854	49,860	1,421	587	0.35	552	184	368	127	254	0.2	0.1

^e Including Summit Region of water-shed.

† Cotton produced mostly on Rim lands or Valley lands of the Table-lands proper.

TABLE II.—Banner Counties, as regards Total Production and Product per Acre, in each Agricultural Region.

REGIONS ACCORDING TO PRODUCT PER ACRE.	COUNTY HAVING HIGHEST TOTAL PRODUCTION.					COUNTY HAVING HIGHEST PRODUCT PER ACRE.					
	NAME.	Rank in product per acre in State	Acre.	Bales.	Product per acre	NAME.	Rank in production in State.	Acre.	Bales.	Product per acre	Rank in product per acre in State*
Lake County (Mississippi River alluvium) -----	Lake	1	3,249	2,412	0.74	Lake.	23	3,249	2,412	0.74	1
Mississippi River alluvial and Bluff region -----	Shelby	8	92,620	46,388	0.50	{ Dyer.	16	14,637	8,564	0.59	2
						{ Obion.	21	7,259	4,225	0.58	3
Brown Loam and Table-lands † -----	Fayette	13	92,231	39,221	0.43	{ Crockett	14	17,807	9,320	0.52	6
						{ Gibson	5	36,820	19,272	0.52	7
Cumberland Table-lands † -----	Van Buren.	88	29	0.33		Scott.	69	3	2	0.67	
Western Valley of Tennessee River -----	Hardin	23	12,859	5,345	0.42	Humphreys	40	155	90	0.58	
Highland Rim -----	Hickman	22	3,128	1,302	0.42	Montgomery.	69	2	2	1.00	
Central Basin -----	Giles	12.	31,416	13,802	0.44	Trousdale.	75	1	1	1.00	
East Tennessee -----	Hamilton	38	486	143	0.29	Hawkins	74	2	2	1.00	

* Omitting those whose production is less than 100 bales.

† Including summit region of water-shed,

‡ Cotton produced mostly on rim lands, or valley lands of the table-lands proper.

County in the State having highest total production, Shelby, 46,388 bales. County in the State having highest product per acre, Lake, 1,059 pounds of seed cotton. County in the State having highest cotton acreage per square mile, Fayette, 144 acres. County in the State having highest percentage of tilled land in cotton, Shelby, 47.3 per cent.

In the tables the aggregate number of bales produced in each natural division is approximately given. Many counties have portions in two contiguous divisions, which circumstance has caused more or less embarrassment in the attempt to classify the counties with reference to the divisions. For this reason the aggregates are approximations only. The defect, however, has been rectified to a considerable extent in the descriptions of the divisions given in the report.

The *Mississippi Bottom Region*, the smallest of our natural divisions, has the distinction of containing lands which produce the most cotton to the acre. This, however, is only an inference based on general information, as, throwing out Lake County, which is wholly within the bottom, the data were not at hand necessary for the separation of the products of the bottoms from those of the uplands. Lake County reports less than 10 per cent. of its tilled land in cotton, which is much below the average of the river lands south of this county. The yield per acre in Lake was 0.74 of a bale of 475 pounds, the greatest yield recorded for any county.

The great *Plateau-slope Region of West Tennessee* stands pre-eminent within the State in cotton culture, its great expanse of level or gently undulating brown loams, together with the warmer climate, giving it this position. Its first subdivision on the west, the Bluff region, had in 1879 a fraction less than 38 per cent. of its tilled lands in cotton. The yield per acre was 0.53 of a 475-pound bale, the highest rate attained, excepting that for the single county of Lake. The latter result is doubtless attributable in part to the character of the plateau areas of fine siliceous and limy Loess soils of the subdivision. The Mississippi lands within these counties may help to exalt the rate, but they are too limited, comparatively, to affect it materially.

The second subdivision, the Brown Loam Table-lands, the largest subdivision of the Plateau Slope, had also a fraction less than 33 per cent. of its tilled lands in cotton, but its rate of yield per acre was less, being 0.45 of a 475-pound bale. In the third subdivision, the Summit Region of the water-shed, there is a material falling off in the proportion of tilled land in cotton, it being 19.4 per cent. The yield per acre was 0.42 of the standard bale.

In the *Western Valley of the Tennessee River* the percentage of cotton production is much reduced, especially in the northern part of the State. On the eastern side of the Tennessee, north of Duck River, it is, excepting a spot in Stewart County, practically nothing. Within the cotton-producing portion of this Valley the percentage of tilled land in cotton was not quite 7 per cent. The yield per acre was 0.40 of a bale.

Next follows the *Western subdivision of the great Highland Rim*. This high "barreny" belt of country, with areas of low-est production alternating with areas of non-production, lies between the two chief regions of cotton culture, and almost makes a break in the continuity of the cotton-belt as a whole. What cotton is put to its credit was mostly raised in the deep valleys intersecting the belt.

The *Central Basin* as a cotton-producing area rates pretty well in the number of bales and in the percentage of the total acreage with that part of West Tennessee, nearly half, which embraces, with Benton, the two northern tiers of counties. Including as a part of the Basin area the valley of Duck River, in Hickman, the West Tennessee fraction had the better of it by about 1,000 bales. In the Basin, as a whole, the proportion of tilled lands in cotton was 6.4 per cent.; in a number of the northern counties, however, little or no cotton was planted, tobacco taking its place. If the non-cotton counties and parts of counties could be thrown out the proportion of tilled land in cotton would be much greater. For Giles County, as the case stands, it is 18 per cent.; for Rutherford, 16; for Maury, 10; for Williamson, 7. The yield per acre for the cotton area

proper of the basin is 0.40 of a 475-pound bale. Giles goes above this, the yield being 0.44 of a bale. Rutherford and Williamson fall to 0.38 of a bale.

East of the Basin the two mountainous divisions, the *Cumberland Table-land* and the *Unaka Mountain region*, are non-producing as to cotton. The remainder of this part of the State, the *Eastern subdivision of the Highland Rim* and the *Valley of East Tennessee*, is in the penumbral region of cotton-growing. It would appear that the culture of cotton in the Valley of East Tennessee had been advancing to some extent northward for a few years previous to 1880.

RELATIONS OF COTTON PRODUCTION TO THE RACES.

As to the relations of whites and negroes to cotton culture and production, Table I. authorizes the broad statement that where the greatest aggregate of cotton is produced, there is, other things being equal, the greatest negro population; and, further, that as the one decreases in the several belts, the other does also, though not necessarily at the same rate. Take, for example, the group of six counties in West Tennessee (Shelby, Fayette, Hardeman, Tipton, Haywood and Madison), producing the most cotton and embracing the greatest acreage in cotton (15 per cent. and above), and we find that they contain nearly one-third (30 per cent.) of the entire negro population of the State, although their aggregate area is a little less than one-twelfth (about 8 per cent.) of the area of the State. And it makes little difference in this estimate if Shelby, with Memphis, be thrown out of the calculation. In this same group of counties the negro population is 57 per cent. of the total population. Similar calculations as to the production and population, especially in West Tennessee, will bear out, in general, both statements made. In the Central Basin the relations cannot be made so apparent, chiefly because the data are not at hand for making out the negro population of each separately. A real aberration, however, in the force of the statement is caused by the fact that some of the very rich counties, either in whole or



in part, especially in the northern portion of the Basin, find profitable employment for negro labor other than in the raising of cotton. Another circumstance to be considered, both as to West and to Middle Tennessee, is the presence of large and prosperous towns and cities in which negroes congregate, and which cannot always be eliminated in the calculations. We add that the negro population of the cotton region as a whole is approximately 68 per cent. of the entire negro population of the State, while its area is only about 48 per cent. of that of the State.

It must also be stated that while the greatest number of negroes are found in areas of greatest aggregate production, yet it does not follow that in such areas the most cotton is produced per acre. In the six counties referred to, in the southwestern corner of the State, we have, area for area, the most cotton produced and the highest percentage of negro population, with an average yield per acre of $0.46\frac{1}{2}$ of a 475-pound bale, while in another group of counties in the northwestern corner of the State (Lake, Obion, Dyer, Lauderdale, Gibson and Crockett), where the relative production and percentages of negro population are much less, we have an average yield per acre of $0.58\frac{1}{2}$ of the standard bale—a wide difference. This is in the case before us, due much, but not altogether, to the differences in the qualities of the soils concerned. How far the kind of labor or to race enters as a factor in such results is a question for consideration.

METHODS OF COTTON CULTURE.

A few general notes are appended as to the agricultural methods employed in the cultivation of cotton within the State.

Fallowing is practiced in all the divisions, but only to a limited extent, and rarely in the alluvial region of the Mississippi. Land lying fallow within the area of the Plateau Slope of West Tennessee and of the Western Valley of the Tennessee River is sometimes tilled, sometimes only turned out. Weeds are often turned under and the land sown in field-peas, or in grain

in place of peas, or sometimes in clover or grass. In the Central Basin the land is, in a majority of cases, only turned out; sometimes sown in clover, grass or wheat. The results in both cases are generally reported as good.

Rotation of crops is generally practiced, but with little system. Cotton, corn and wheat, or corn, cotton and wheat, are made to follow each other in courses of three to four and five years. In the place of wheat, oats or clover, or sometimes peas, sweet potatoes, or even in certain counties peanuts are substituted. On strong land the courses are sometimes reduced to two years, cotton and corn alternating, wheat or oats occasionally taking the place of the latter. It is the rule, perhaps, to change yearly, but there are many exceptions to this, the same crop, as cotton and corn, being raised on the same land for a series of years, covering sometimes a period of five or even ten or more years. The general testimony is, as we might have anticipated, that rotation relieves the land and is of material benefit.

Fall plowing is done to a greater or less extent in all parts of the cotton region, more generally in the Mississippi Bottom and the Bluff Region and in the Central Basin, and less so within the limits of the Brown Loam Table-lands of West Tennessee. It is often done for wheat alone, and the results are very generally reported as good. Subsoil plowing amounts to but little in any of the divisions. When done, a bull-tongue is generally run in the furrow after a turning-plow.

Outside of a scanty supply of stable manure the fertilizers used amount to but little. Land-plaster to a small extent and less guano are applied in the midland counties of West Tennessee. Some plaster is likewise used in the Central Basin, together with a limited amount of manufactured fertilizers. Cotton seed, especially away from cotton seed oil-mills, is thus in part disposed of. In addition, compost material, straw, corn-stalks, ashes, etc., are utilized by provident cultivators. The lands are further often improved by the plowing under of

clover, peas and weeds. The cotton lands of Tennessee are in the main still quite productive as compared with many sections in other States, and there does not exist the same necessity for the use of fertilizers; nevertheless there are areas with us which would be greatly benefitted by a judicious application of artificial or other fertilizers, and which, in truth, need them if good crops are to be expected.

Cotton seed, in addition to its use as manure, is largely employed as a food for cattle, especially in regions remote from cotton seed oil-mills. When transportation to the mills is easy, much of it goes in that direction.

The most troublesome weed in all the cotton region is crab-grass. This is characterized as "most fatal," "great trouble," "pest," "worst enemy," etc. Cocklebur ranks second, and careless-weed or smart-weed third as "pests" in all parts except the Central Basin, where careless-weed is second and cocklebur third. Other more prominent weeds are foxtail grass, rag-weed, purslane and hog-weed.

The farms or plantations in the cotton region, as a whole, vary from five to 2,000 acres, rarely 3,000. The largest are in the alluvial region of the Mississippi, the midland counties of West Tennessee and the Central Basin. It is impossible to make out the average size of farms from the answers in the schedules with even an approximation to correctness, either for the whole area or any of its leading subdivisions.

Mixed farming is general throughout the entire region.

Supplies are everywhere chiefly raised at home. In West Tennessee some are imported from St. Louis, Memphis, Cincinnati, Louisville and Nashville, the point from which they are imported depending upon the facility of transportation. The tendency of raising supplies at home is evidently increasing.

Taking the whole cotton region into consideration, the chief laborers are negroes, and landlords often express a decided pref-

erence for them. There are no Chinese, and but few foreigners of any kind. In some parts of the region the proportion of white as compared with negro laborers is considerable. In the extreme northwestern counties the proportion is large, more than half, and in the Summit Region of the water-shed it is about half; but in the Western Valley of the Tennessee River and in the western subdivision of the Highlands the whites predominate.

The wages paid will average throughout the area about \$10 per month, including board. In the extreme western part the rates appear to be higher, averaging \$12. In most cases the wages are due at the end of the year, though money and provisions may be advanced at any time. Many are hired by the month, and even by the day. Farms are often worked on shares. In such cases the landlords furnish, for the most part, all implements and the means necessary for the support of hands and for carrying on the farm work. In general, the system gives satisfaction, though occasionally objections are recorded against it.

The proportion of negroes owning houses or land is small, approximately five per cent. for the whole region. In the Bluff and midland counties of West Tennessee and in the Central Basin the proportion is, according to reports, from four to five per cent. In the section lying between these, where the negro population is comparatively small (the Tennessee Ridge region, the Western Valley of the Tennessee and the Highlands), the proportion is greater, ranging from eight to thirteen per cent. The reports vary much as to the condition of the negroes, the general inference to be drawn being that the frugal and industrious—and there are not a few of this class—are prosperous, improving, and, in general, doing well; but that the improvident and indolent, of whom there are too many, are poor and uncomfortable and likely to remain so. There is a general disposition to treat them fairly and kindly, though in rare cases, doubtless, they are imposed upon by selfish and designing men.

A remark further is added as to the increase in the total cotton product of 1879 over that of 1869, as shown by the census

reports. Taking the whole State, and allowing for manifest errors in the report of 1870, and making the proper reductions, the total product of 1869 becomes 147,824 bales of 475 pounds each, and the total for 1879 is 330,621 bales, an increase of 124 per cent. over the product of 1869. The main increase was in West Tennessee. In the Central Basin it amounted to 47 per cent. In East Tennessee it was greater than elsewhere, though here but comparatively little cotton is raised.

TABLE of Analyses of Tennessee Soils and Subsoils.

Number.	NAME.	LOCALITY.	COUNTY.	VEGETATION.	Depth in inches.	Insoluble residue.	Soluble silica.	Total insoluble residue and silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of man- ganes.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Volatile matter.	Total.	Hygrosopic moisture.	Temperature of absorp- tion C.
1	Red cl'y soil	Florence sta.	Rutherford	Species of hickory, red, white and post oaks, elms, ash, honey-locust, black walnut, wild cherry, sugar-tree, poplar, hackberry, red-bud, dog-wood and pawpaw. Originally covered with cane.	7 79.580	3.628	83.208	0.156	0.065	3.054	0.029	0.195	3.420	4.988	0.242	0.069	4.962	100.402	8.64	2.9	
2	Red cl'y subsoil	do	do		7 to 15	66.092	11.697	77.789	0.508	0.088	0.119	0.204	0.272	6.337	10.299	0.305	0.079	3.728	100.228	8.84	17.2
3	Red cl'y soil	do	do		7 80.850	5.266	86.116	0.140	0.034	0.510	0.024	0.175	3.708	4.173	0.207	0.102	4.784	99.973	7.23	28.9	
4	Red cl'y subsoil	do	do		7 to 15	81.670	6.060	87.750	0.211	0.033	0.161	0.301	0.157	3.613	6.220	0.066	0.008	1.966	100.476	5.59	17.2
7	Red cl'y soil	J W Burt's 8 miles n. of M'freesboro	do	About as above.	8 75.350	7.310	82.660	0.255	0.258	0.340	0.296	0.038	5.181	5.567	0.079	0.079	4.962	99.718	7.29	22.2	
8	Red cl'y subsoil	do	do		8 to 20	76.470	6.010	82.480	0.251	0.050	0.142	0.074	0.149	4.773	7.774	0.066	0.072	4.230	100.061	7.93	22.2
9	Red cl'y soil	W G Hardig	Davidson	Oaks, elms, hickories, ash, poplar, linden, sugar-maple, hornbeam, walnut, cherry, dog-wood, and red-bud. Originally in cane.	8 56.540	8.840	65.390	0.368	0.108	6.540	0.569	0.187	7.286	12.419	0.563	0.156	6.318	99.994	10.56	26.6	
10	Red cl'y subsoil	do	do		8 to 20	47.950	11.010	68.960	0.762	0.174	8.382	0.615	0.091	9.534	17.303	0.355	0.188	3.591	99.995	11.01	26.6
6	Red cl'y subsoil	do	do		8 to 20	54.332	10.540	65.472	0.242	0.064	3.015	0.675	0.152	9.761	16.272	0.175	0.119	4.208	100.145	9.70	17.8
11	Poplar soil	Van Polk's	Maury		11 79.270	5.472	84.742	0.319	0.069	0.515	0.342	0.040	3.683	5.294	0.349	0.192	3.549	100.064	8.62	29.0	
12	Poplar subsoil	do	do	Originally covered with cane.	11 to 23	73.340	8.531	81.871	0.327	0.080	0.547	0.353	0.083	5.295	7.120	0.342	0.107	3.372	99.497	11.43	29.0

13 Poplar soil	Hermitage...	Davidson	} About the same as 11 & 12 {	10 78.960	6.900	85.660	0.228	0.047	0.378	0.368	0.063	2.037	6.066	0.235	0.083	4.496	100.415	10.02	26.2
14 Poplar subsoil	do.....	do.....		10 to 22 75.100	8.930	84.080	0.584	0.114	0.468	0.444	0.054	8.008	6.979	0.318	0.066	2.483	99.228	10.00	26.2
15 Upland soil.....	Gill's station	Shelby....	} Poplar, sweet-gum and hickories; oaks, red- bud and dogwood. Cane originally.	6 84.646	4.466	89.112	0.322	0.085	0.248	0.077	0.080	2.416	2.383	0.083	0.080	4.159	99.856	5.00	16.0
16 Upland subsoil	do.....	do.....		6 to 18 83.128	3.853	96.381	0.399	0.131	0.243	0.498	0.042	3.664	5.026	0.064	0.010	2.057	99.668	6.31	17.0
17 Loess soil	*Memph. bluff	do.....	.....	73.113	3.890	76.508	0.433	0.190	3.967	3.391	0.084	4.687	3.102	0.319	0.060	1.780	99.927	4.67	.....

*The Loess soil from the Memphis bluff shows, in addition to analysis, 5.561 carbonic acid.

NOTE.—With the exception of Nos. 3, 4, 7 and 8, the soils and subsoils analyzed were each an average sample obtained by thoroughly mixing samples taken in the same lot from three excavations or holes dug for the purpose. Nos. 3 and 4 were obtained from a single hole, and are not averages. Nos. 7 and 8 are each an average of four samples from as many holes. In every case the lands supplying the samples have never been cultivated or entirely cleared. All are pasture grounds, with more or less of the native growth remaining.

The above table is compiled from analyses made by the following persons: Nos. 1 and 3, by Durrett; No. 2, by McCauley; Nos. 4, 6, 7, 9, 10, 11, 12, 13 and 14, by Cory; Nos. 15, 16 and 17 by Colby.

REPORT
ON THE
Economic Entomology of Tennessee

—BY—

E. W. DORAN,

*Assistant Entomologist to the Bureau of Agriculture, Statistics and
Mines, and Acting State Entomologist,*

—TO—

A. J. McWHIRTER, Commissioner.
1886.

LETTER OF TRANSMITTAL.

HON. A. J. McWHIRTER, *Commissioner of Agriculture, Statistics,
Mines and Immigration:*

In accordance with your instructions, I herewith submit my report as Entomological Assistant to your Bureau.

Having received my appointment but a short time before the beginning of the new year, I had but little opportunity to study the habits of our insects till the opening of spring. And since I am required to make my report so early, it really represents but a few months' work, which, from the very nature of the case must be somewhat imperfect, since a great many of the insects I have been studying have not completed their transformations, and on this account I am compelled, in some cases, to present an incomplete record. While much that is begun cannot be presented till another season is given for observation. You will remember, too, that only a small portion of my time could be given to the work, on account of my manifold duties in the management of an institution of learning. And since my services to the State have been gratuitous entirely, I could not well visit the different sections of the State to make observations, though in several cases I could, no doubt, have done much good should I have done so, notably in the case of the ravages of the Buffalo Gnat. On this account, then, my work is very unsatisfactory to myself, as I fear it will be to you and the people.

During the latter part of summer I moved from London to this place, and in consequence made but few observations for several weeks, and was unable to carry out many experiments begun, and an important chapter was lost in the life history of several insects.

My great isolation from other working entomologists, coupled with the fact that this is practically a new field, should also be taken into consideration. Many of the other States north of us have entomologists and trained observers throughout the country; but from the Ohio River half way to the Gulf, and from the Alleghanies to the Mississippi is a large district in which but little work has been done; and it is a rare thing that any reference in regard to the insects of this State is found in other reports.

The foregoing considerations I think are sufficient to demonstrate this fact, viz: There ought to be an entomologist in Tennessee, employed for all his time, and at a compensation that will permit and insure thorough and practical work in every section of our great State. I believe the intelligent farmers of the State realize this. Last May I had the honor to address that influential body of men composing the East Tennessee Farmers' Convention, the only organization of the kind in the State, and I believe in the South. The subject of Economic Entomology was discussed by the Convention for nearly two hours, in most spirited and eloquent talks by various members, and the following resolution was adopted by a hearty response, without a dissenting voice:

"Inasmuch as we hear of the widespread destruction caused by injurious insects on every hand,

"*Resolved*, That it is the sense of this Convention that an appropriation should be made by the Legislature to employ an entomologist for all his time. And we do most respectfully call the attention of our next General Assembly to this subject."

Numerous articles, editorial and otherwise, have appeared during the year in that farmers' best friend, the *Spirit of the Farm*, advocating this same measure.

During the year I have conducted a department of entomology in the *Spirit of the Farm*, that I might disseminate a knowl-

edge of our most injurious insects, and suggest remedies, in time to be used in protecting the present crop. Some of the same insects therein mentioned have been treated in this report, that fuller and more accurate information could be given, and in many cases records of more recent observations. They are also given in a form more permanent and convenient for reference. This report should be used for future reference, as a man uses his dictionary or encyclopedia.

Another reason for presenting some of the same subjects is that they were not illustrated in the columns of the paper, while now I am glad to be able to present good figures of most of the insects treated.

The following pages have been written for farmers, hence the subjects have been treated in the most practical way possible, and as few scientific or purely technical terms used as is consistent with accuracy.

At the close of this report are to be found these appendixes: Appendix "A" is devoted to an address before mentioned, on "Life and Habits of Insects," delivered before the East Tennessee Farmers' Convention in session at Knoxville, May 19, 1886. Appendix "B" contains an address delivered before the same body at the same place, on "Economic Entomology," May 18, 1885. Though the latter was not delivered since my appointment was made, I have thought it proper to incorporate this in a permanent form, as a contribution to the very meager literature of the subject in this State.

My obligations are due to you for many valuable suggestions and for practical encouragement. To Dr. W. M. Clark, editor of the *Spirit of the Farm*, and many others, for reports of observations; to Dr. F. M. Goding, who for several months was a resident of my own town, for the use of his library and useful suggestions at the beginning of my work; to Prof. S. A. Forbes, State Entomologist of Illinois; Prof. C. V. Riley, United States Entomologist; Prof. F. M. Webster, Lafayette,

Indiana; Prof. G. H. French, Carbondale, Illinois, and many other correspondents for practical suggestions, determination of insects, etc.

I am, most respectfully yours,

E. W. DORAN,
Assistant Entomologist.

GREENEVILLE, TENN., Nov. 1, 1886.

INTRODUCTION.

To those who have not thoroughly studied the subject, it is but meet that a few thoughts should be presented on the importance of the study of Entomology. The reader is requested to read the two addresses, comprising Appendixes "B" and "C." The subject is well worthy the careful attention of the farmer. It is absolutely necessary that the farmer learn something of his insect foes, something of their habits and their appearance in the different stages, in order that he may successfully combat them.

Some of our leading educators are recommending that entomology be taught in the common schools, that the farmer boys and girls may obtain a practical knowledge of the subject, that they may know best how to protect fields, gardens or flowers from insect ravages. Entomology is now taught in the public schools of California. I give here quotations from two articles which appeared during the summer, and were copied in my department of the *Spirit of the Farm*:

"In this age, when the cry of practical seems to be the watchword by which all our studies are gauged, can there be any study more practical than this? If we consider the vast amount that is lost every year to the farmer and horticulturist by insects, it seems to me it is important that those most interested should learn more of the habits of these little depredators, and how can it better be done than that the subject be made one of the regular studies for a short time every year in every district in the State? To be sure, we have our State Entomologist, whose services we cannot well dispense with; but how much more could he do if aided by a people alive to the interests at stake?"

The following is from an editor of a prominent horticultural paper:

"We have nearly passed the mathematical epoch when it was thought little else was needed to fit a boy or a girl for the practical duties of life than a knowledge of arithmetic, written and mental, algebra and geometry. The demands of the age are for skilled, practical capacities. Entomology, as a science of the common people, is of but recent date. * * * * * These creeping, buzzing contrabands affect more nearly the vital interests of the American people than tariff, silver coinage, foreign relations and other subjects of national legislation. It would seem very reasonable that in the equipment of the embryonic farmer there should be found some acquaintance with insect enemies, who will declare war against the labor of his hands just as soon as he becomes a tiller of the soil. Facilities for obtaining such an education ought to be provided in every district school."

Entomology is a fascinating study. I have repeatedly given instruction to boys and girls from twelve to fifteen years old, and to young ladies and gentlemen, and they have always proved to be my most interesting classes. I have a number of enthusiastic young students of nature about me now, who, in another year, will be able to render valuable service to the neighborhood and to the State.



WEDGEWOOD, 2:19.

By Belmont, dam Woodbine; the dam of Woodford Mambrino.
Property of HERMITAGE STUD CO., Nashville, Tenn.

ENTOMOLOGICAL CALENDAR.

There seems to have been greater insect destruction than usual this past summer. It is possible, however, that the subject of economic entomology having been brought more prominently before the people, the reports of injuries have become more numerous. Frequent mention of the damage done has been made through the agricultural press, and even the various weekly and daily newspapers. I cannot present the extent of their ravages in a more satisfactory and accurate way than by giving

A Summary of the References to Insect Attacks in the Monthly Crop Reports, Published by the Commissioner of Agriculture.

		East Tennessee.	Middle Tennessee.	West Tennessee.	Entire State.
Cut-worms -----	{ May -----	18	36	4	58
	{ June -----	4	7	0	11
Colorado potato beetles -----	{ May -----	5	8	0	13
	{ June -----	2	0	0	2
Grasshoppers -----	{ May -----	0	1	0	1
	{ June -----	0	3	1	4
Hessian fly -----	{ May -----	1	0	0	1
	{ June -----	0	1	0	1
All others -----	{ May -----	4	8	3	15
	{ June -----	7	2	2	11
Totals -----		41	66	10	117

I have singled out these insects in the foregoing table because they seem to have been the most injurious, with the exception of the Hessian fly which has been conspicuously scarce, as com-

pared with previous years. The Commissioner's Crop Report for 1884 showed that ten per cent. of all the wheat in the State was destroyed by the "fly," while this year only two counties report it.

Much has been said concerning the great injuries to stock by the Buffalo gnat, but only two counties mention it in their reports. However, the insect has done great injury to stock in some parts of the State.

Cut-worms and the Colorado Potato beetle seem to have done far more injury than any other two insects. This is no doubt true; but the farmers in general are more familiar with these than most other insects, and hence more likely to report them.

The Peach-tree Borer (*Ægeria exitiosa*), the Squash-vine Borer (*Melittia cucumbertæ*), the Plum Curculio (*Conotrachelus nenuphar*), the larva of the Cabbage Butterfly (*Pieris rapæ*), the Harlequin Cabbage Bug (*Murgantia histrionica*), the Striped Cucumber Beetle (*Diabrotica vittata*), and the Corn-worm or Boll-worm (*Heliothus armigera*), have all been somewhat injurious.

CLASSIFICATION.

Since by far the greater number who read these pages are comparatively unacquainted with the different orders, families, etc., into which insects are divided, it is meet that I devote some space to that subject, in order that the remainder of the report be more thoroughly understood and appreciated, otherwise the class to be benefited, the farmers, gardeners and horticulturists, many of whom, having access to no entomological library, would fail to receive the greatest good possible. It is to be hoped especially that farmers' sons and daughters, having leisure, will acquaint themselves as much as possible with the subject of entomology, and make careful observations in regard to the insects found infesting the crops, garden products or flowers. It will be a pleasant and profitable recreation.

Preceding the classification, I present a few facts concerning the earlier stages of insects. This is in part condensed and re-

arranged from an article on the subject by the writer in the January number of the *Youths' Treasury*, published at Nashville, Tenn.

The term *insect* is properly applied only to that class of articulate animals having six legs, and the body divided into three parts—head, thorax and abdomen. To the head are attached two somewhat thread-like, or horn-like, organs, called antennæ, while the legs and wings, when present, are attached to the thorax. In addition to the usual number of six legs, caterpillars generally have from six to ten short, fleshy pro-legs, used in locomotion. Insects may be readily distinguished from spiders, mites, ticks, centipedes, millipedes, etc., by the number of legs.

Insects exist in four stages, viz: the egg, larva, pupa and imago, or perfect form. The eggs, usually deposited in a place convenient for food for the young insect, hatching, produce the larvæ. In some species the larva is called a caterpillar, is often covered with hair, has from twelve to sixteen legs (including *pro-legs*), and often lives exposed on plants and trees. Sometimes the larva is a footless grub or maggot, boring into trees, decaying flesh, or living upon plants.

The larva finally develops into the pupa, which, in most insects, eats nothing, is covered with a hard skin, or case, and often a cocoon of silk, or other material. Such insects as grasshoppers and crickets, and others belonging to the order Hemiptera, are active during their entire life.

Finally the pupa is changed to the perfect insect, which deposits eggs for another brood, and having lived out its days, dies, and is no more. Some live but a single day, take no food, and never leave the spot where they reached their maturity.

The *class* (or sub-class) of insects is divided most generally by recent authorities into seven *orders*; orders are divided into *families*, families into *genera* (singular, *genus*), and the genera into species. The technical name of an insect comprises both its generic and specific names.

The following are the seven orders, beginning with the highest in rank:

1. *Hymenoptera*, or membrane-winged insects. This order includes bees, wasps, hornets, ants, saw-flies, ichneumon flies, etc. They may be divided into two classes, first, those in which the females are provided with a sting; second, those in which the females are provided with a kind of piercer, or saw, for boring into substances in which to deposit their eggs. The insects of this order undergo complete transformations. The larvæ of the stingers are soft, white, footless maggots. Some of the piercers resemble them; others have hard, horny heads and six legs, and sometimes a number of short, fleshy legs besides.

2. *Lepidoptera*, or scale-winged insects. This order comprises butterflies, which fly during the day; moths, which usually fly at night, and hawk-moths, or sphinges, which usually fly at twilight, but occasionally in the bright sunshine. The butterflies have slender bodies, usually fold their wings together over their backs when at rest, and their antennæ have a distinct knob, or club, at the end. The moths have heavy bodies, usually fold their wings over their backs when at rest, like the roof of a house, and their antennæ are not knobbed. The hawk-moths, or humming-bird moths, as they are sometimes called, have large, pointed, spindle-shaped bodies, long, narrow wings, antennæ not knobbed, but often ending in a hook.

The insects of this order undergo complete transformations. In the larva stage they are called caterpillars. The pupæ of the butterflies are attached to some object and have no cocoons. Some of the moths spend the pupa stage in the ground, others in a silken cocoon. The sphinges enter the ground to pupate.

3. *Diptera*, or two-winged insects. This order includes flies, gnats, Hessian flies, mosquitoes, etc. They take their food by means of a sucker, which incloses several fine bristles, with which they sometimes inflict painful wounds. The larvæ of flies and gnats are fleshy maggots; mosquitoes, buffalo gnats, etc., pass the larval stage in the water; others live in vegetation. They are inactive in the pupa stage, but some of them, just before changing to the perfect state, are enabled to move about a little.

4. *Coleoptera*, or sheath-winged insects. The insects of this order are called beetles. They have four wings, but the outer two, the elitra, are horny or leathery, and not used for flight, but as a protection for the delicate under wings. The larva stage is found in various situations, as in the ground, decaying wood, boring into trees, or upon plants. The pupa stage is passed under ground, in vegetables, fruit, etc.

5. *Hemiptera*, or half-winged insects. These are also called bugs. The term is properly applied only to insects of this order. The squash-bug, bed-bug, plant louse, tree hoppers, cicada or seventeen-year locust, etc., belong to this order. They have a slender beak which lies bent under the body when not in use, and live by sucking the juices from plants. They undergo all the transformations, but many of them are very similar to the perfect insect in all their stages, and take food and are active during the pupa stage. They are divided into two sub-orders:

(1) *Heteroptera*, having the wings thick and leathery at the base, the rest thin and somewhat transparent.

(2) *Homoptera*, having the wings the same throughout.

6. *Orthoptera*, or straight-winged insects. Crickets, locusts, grass hoppers, katydids, cockroaches, walking-sticks, etc., are included in this division. They are sometimes divided into four groups, according to the character of the legs, and manner of locomotion. These four groups are: (1) Runners; (2) Graspers; (3) Walkers, and (4) Jumpers.

They do not undergo complete transformations. The young resemble the adult very much in appearance except in the development of their wings. They are active and continue to feed throughout their whole lives.

7. *Neuroptera*, or nerve-winged insects. In this order are found dragon-flies, May-flies, lace-wings, ant-lions, white ants, etc. Their wings have a net-work of veins. The larvæ of dragon-flies live in the water. The larvæ of ant-lions dig holes into the sand, and, concealing themselves at the bottom, devour any luckless victims falling into their den. Most of the insects of this order are not injurious; but the white-ants, wood-lice and wood-ticks are exceptions.

By reference to the foregoing classification the farmer will be able to refer almost any insect he may find to its proper order with very little trouble. Each insect treated in the body of this report will have the order and family to which it belongs designated, and the name of the insect itself comprises its genus and species. Hence, at a glance the order, family, genus and species of each insect treated is ascertained.

REMEDIES

The remedies for insect injuries may be classified as natural and artificial. Oftentimes the means of protection which nature affords are entirely sufficient, and no doubt would always be so, if civilization did not disturb the equilibrium. It is well to know what some of the natural agencies are before we apply artificial methods.

One of the chief of these is birds. I fear we often underestimate the good they do. Prof. S. A. Forbes, the learned State Entomologist of Illinois, made a thorough study of this subject a few years ago. By a microscopical examination of the contents of the stomachs of hundreds of birds, he was able to demonstrate that their food consists more largely of insect-food than is generally supposed.

Chickens and turkeys are often valuable in the garden or field. Hogs and sheep are useful for destroying fallen fruit containing insects, and hogs destroy many about the roots of trees by rooting out and eating. The toad is a valuable friend in the garden. Almost every jump he makes some insect is instantly snapped up by his long, adhesive tongue. French gardeners, it is said, readily pay fifty cents a dozen for toads.

Even skunks are rendered less obnoxious by the fact that they are useful in destroying grubs and other pests. Ladybugs (*coccinellidæ*) are of great service, both as larvæ and adults, in destroying plant lice.

Insect parasites are perhaps as potent defenders of our crops as any other one factor. They should not be destroyed, and may be transported into regions where they are not found in abundance.

Among the most effective artificial remedies are those given below. The list is largely prepared and abridged from Prof. J. A. Lintner's first report as State Entomologist of New York, and the remedies have been thoroughly tried. These will be referred to often throughout the report, but not repeated, and are collected here for convenience for reference.

1. *Paris Green*. This insecticide first came into extensive use for the destruction of the Colorado Potato Beetle, so ruinous to the potato crop of the Northern and Middle United States. Some of the druggists in agricultural centers of the West ordered it by the ton for this purpose. It is also used against many other insects. There are many who are unwilling to use it because it is such a virulent poison. Great care should be had in handling and using it. It may be used dry or mixed with water or other liquid. If used dry, it is mixed with some other substance for diluting, such as flour, plaster, ashes, air-slacked lime and road dust. Of these, flour is the best, since it will be more readily eaten and adheres better to the leaves. For potatoes, one pound of the Paris Green may be used to twelve of the flour. Other plants will require that twenty pounds or more of flour be mixed with one of the Green. Plaster of paris is cheaper, and is also a fertilizer. Fifty pounds of this or more may be used with one of the poison.

The most simple remedy for using the dry mixture is to tie a muslin bag containing the substance to a stick and shake it over the plants. Another and a better one is to use a tin box or cup, with the bottom finely perforated or composed of fine wire gauze, to which a good long stick may be attached for carrying and dusting over the vines. When applying the powder, keep to the windward of the plants that none of the poison be inhaled. Other contrivances are used for dusting large fields.

The liquid application has several advantages over the dry. It can be applied faster, gives a more equable application, and can also be used on fruit trees. A half pound of the poison may be used with forty gallons of water. For some plants the application may be made doubly strong. In applying to small areas, one tablespoonful may be used to four gallons of water. It is better if two or three pounds of flour boiled into paste be

mixed with each bucketful of water. If the flour is mixed with the water and set aside till it sours, it need not be boiled.

To apply the liquid on a small scale, a brush broom, or other similar contrivance, may be used. A more convenient method of applying is by using a watering-pot, with fine rose for sprinkling. A still better arrangement is that of having a large can fastened on the back, with two rubber tubes with nozzles, or sprinklers, attached. Prof. C. V. Riley describes a contrivance of this kind in his Seventh Missouri Report. For spraying shrubs, vines, bushes, trees, etc., it is necessary to use some kind of force-pump.

There are various kinds in use, some of which are simple and cheap, while other better ones are high priced.

I have used a small pump manufactured by T. A. Snow, Chattanooga, Tenn., which is sold for \$1.25. If trees are not too large, say not more than fifteen feet high, a spray can be thrown to the top. A jet of water can be thrown much higher. It is a very useful little pump and well worth the price at which it is sold. No farmer should be without a pump of this kind, or a larger and more expensive one.

The Union Manufacturing Company, New Britain, Conn., make such a pump. I have tried one of their pumps, and believe it to be in every way equal to the pumps I have usually seen recommended by entomologists, costing from \$8 to \$10 each, while this pump can be had from the manufacturers for \$4.50 each, while another style almost as good sells for \$4. I am glad that I have been able to secure these pumps for the farmers and orchardists of Tennessee for about half the usual price. Either of these, it is claimed, will throw about eight gallons of water per minute thirty to fifty feet high, with the power of only one hand applied. Each of these has a brass discharge-pipe and sprinkler. One of the pumps stands in the vessel of water while in use; the other has a hose-pipe, which is dropped into the vessel containing the liquid. These pumps can be made to save more than they cost in a very short time.

There has been no little opposition among scientific men, as well as the farmers themselves, in regard to the use of Paris

green so extensively as an insecticide. Prof. Lintner says: "It now believed by those who have given the subject the closest study, that with proper precaution, and in obedience to directions, it may be used with entire safety." He then gives the following precautions, which should be kept in mind:

The poison should be kept in a safe place and plainly labled "Poison."

Do not distribute the powder with the hand, as is sometimes done. An abrasion of the skin might result in serious harm.

Apply the powder with the wind, if any so as not to breathe it,

Do not use it upon leaves or fruit which are soon to be eaten or where it will not be washed away by repeated rains (as on cabbage, cauliflower, etc).

Prevent animals from feeding on poisoned vegetation, and poultry from eating the poisoned insects.

Test the strength of the poison upon a few plants first, lest it may be too strong for the leaves.

Use it of no greater strength than is necessary to kill the insects.

I have found numerous persons who were afraid to use Paris green, even on potatoes, lest the tuber should be injured by a slight sprinkling of the vines. The chemist of the United States Department of Agriculture has ascertained by careful experiments, that 900 pounds of Paris green to the acre will not injure the soil. One or two pounds per acre is sufficient for potatoes. He further shows that "arsenic can not be absorbed and assimilated by the plant in the economy of growth," and "potatoes subjected to applications of Paris green failed to give evidence of the presence of arsenic."

This insecticide is useful in destroying the following insects, among others: The Colorado potato beetles, other potato or blister beetles, cucumber flea beetle, (*Epitrix cucumeris*, Harris), striped cucumber beetle, (*Diabrotica vittata*, Fab.) and other leaf-eating beetles, with their larvæ. It may also be sprayed upon trees when not bearing fruit, to destroy various caterpillars, as

those that feed upon shade trees, evergreens, etc., or such as the canker-worm, which appear very early in the season, before the fruit is formed, or has attained any considerable size.

2. *London Purple*. This is a refuse material obtained in the manufacture of aniline dyes. It is much cheaper than Paris green, and takes less of it, but for many insects is about as effective, though acting more slowly. The effects are not apparent for two or three days sometimes. It is also less likely to be adulterated, being so much cheaper, is more adhesive to vegetation, its effects more permanent, admits of more thorough mixture when used dry, more easily kept in suspension in water, less poisonous when mixed for use, and imparts a color to vegetation which may prevent the careless use of the poisoned plants for use.

It may be used dry, mixed with flour, etc., as Paris green, and dusted upon the plants. Use about one pound of London purple to forty pounds of flour, or other substance employed for general purposes, but one pound of the poison to seventy of the flour will often prove effectual, while one pound to ten will injure only the most delicate vegetation.

It may also be applied mixed with water, in the proportion of one pound to forty gallons. However, an application of half this strength will be found sufficient for many insects, especially the cotton worm (*Aletia argillacea*, Hubn). A small quantity of flour may be added to the water to give greater adhesiveness.

London purple has been found very effective in destroying the codling moth (*Carpocapsa pomonella*, Linn). It should be used early in the season, soon after the apple begins to form. It seems, from the experiments of Prof. A. J. Cook, that there is no danger of poisoning the fruit for use in this way, as he and his family freely ate of the fruit which had been so treated.

3. *Pyrethrum*. This substance is formed of the finely powdered flowers of a species of *Pyrethrum* plant, which is now cultivated in different parts of the United States for insecticidal purposes.

This may be used very much as the preceding, as a powder or mixed in water, and in addition to these it is used as a fume, as a tea or decoction, and as an alcoholic extract diluted.

It may be used as a powder without diluting; but if fresh and strong, may also be mixed with flour or other substance—one pound of the insecticide to fifteen or twenty pounds of the diluent. It is much more effective if mixed one or two days before using and kept in an air-tight vessel.

The water solution seems to be the most effectual. For most insects one ounce of the Pyrethrum mixed with four gallons of water, well sprayed upon the plants, was found to be serviceable. It loses its strength after standing two or three days. If the powder is not fresh and strong, greater quantities must be used. Its effects are not fatal sometimes for a day or two after being applied.

Its application in fumes, decoction or alcoholic extract do not seem to be convenient for general use.

Pyrethrum may be used against a large number of insects—such as the cabbage worm (*Pieris rapæ*, Linn), Colorado potato beetles and dozens of others.

4. *Hellebore*. This substance is prepared from the root of white hellebore, and is far-famed for its sudden destruction of the currant worm (*Nematus ventricosus*, Klug). For this insect it is a most complete and unfailing remedy.

It may be used very much as the preceding. In using it as a powder, dusting boxes, such as previously mentioned, attached to a stick will be found most convenient—a tin can with perforated bottom, or with a muslin cloth tied over the end, or even a muslin bag. Quiet days should be selected for dusting, and the wind should blow the dust from you, as it excites violent sneezing when breathed into the nostrils. A very slight dusting of the leaves is all that is required, as the smallest particle is sufficient to kill some insects. It not only kills by contact, but is equally fatal when eaten by insects.

When applied as a liquid, one pound of the powder may be used with twenty or twenty-five gallons of water, or about three tablespoonfuls to a pail of water, finely sprayed over the plants. As in the case of other insecticides, a small quantity of flour added to the water will make the hellebore more ad-

hesive, and consequently its effects will be more durable in killing larvæ hatching after the application, or any that may have escaped contact with it when applied.

Hellebore may be used against a large number of insects, including saw-flies, to which family belong the currant worm, the cherry or pear slug (*Selandria cerasi*; Peck), the rose slug (*S. rosæ*, Harris), the grape saw-fly (*S. vitis*, Norton), and numerous other "slugs," also the imported cabbage worm (*Pieris rapæ*, Linn), etc.

5. *Kerosene*. The oils in general are deadly to insects, and especially is this true of kerosene. It has the advantage, too, of not being poisonous, though it also has the disadvantage of sometimes proving injurious to vegetation. It requires somewhat more labor in its preparation, on account of the difficulty experienced in diluting with water. There are many uses to which it may be put, however, without diluting; as for destroying lice on stock, fowls, or in henneries, and by destroying other kinds with cloths saturated in it. An emulsion of kerosene and milk, or kerosene, soap and water, may be made, which can afterward be diluted with water to almost any desired extent. Use one part of the milk with two parts of kerosene, which should be thoroughly shaken or churned until it forms an emulsion which is stable, and will not separate, even after standing a day or two. The best means of forming the emulsion is to use a force pump with spray nozzle, forcing the liquid back into the same vessel from which it is pumped. This process will probably require fifteen minutes or more. If the liquid is heated the emulsion will be formed more quickly. This emulsion may then be diluted with water.

The emulsion may also be made from water and soap united with the kerosene. To two gallons of kerosene add one gallon of water, in which has been dissolved by boiling one-fourth pound of whale-oil soap. This may be emulsed as above, then diluted with eight gallons of water. I found that an emulsion of this kind, after it was diluted, would stand for one or two days without separating.

6. *Bisulphide of Carbon*. This insecticide was first used in France as a remedy against the grape phylloxera. Holes are

made into the ground about the roots of plants with a stick or augur devised for the purpose, into which the bisulphide is poured, after which the hole is quickly stopped. The vapor thus given off permeates the ground, destroying all insect life with which it comes in contact.

It may be used against such insects then, especially, as infest the roots of plants, such as the apple-root plant-louse (*Schizoneura lanigera*, Hausm). It might be used, also, against the peach borer (*Ægeria exitiosa*, Say), and the squash-vine borer (*Melittia cucurbitæ*, Harris).

7. *Carbolic Acid*. This substance has been used somewhat as the preceding, for destroying the phylloxera. It may also be used with soft soap, or diluted with water. The former Prof. Cook found useful in destroying the radish fly (*Anthomyia raphani*); while Prof. Lintner used one part of carbolic acid to one hundred parts of water against insects infesting the roots of potted plants.

8. *Coal-tar*. Coal-tar has been employed extensively in destroying the Rocky Mountain locust, and there have been a number of pans, traps, etc., made to entrap the insects. In Colorado it is put into the irrigating ditches, a few drops being sufficient to spread over a large surface of water and kill all insects with which it comes in contact. It has also been recommended as valuable in preventing the plum curculio from depositing its eggs by burning a mixture of coal-tar and sulphur under the trees every other morning during the curculio season.

Coal-tar is a residual quantity produced in the manufacture of gas, and until recently was considered worthless. It can now be purchased probably at about \$2.50 per barrel.

9. *Gas-lime*. This material is a refuse substance produced in large quantities by all our gas works in the manufacture of illuminating gas, and will probably be given away by the companies. Gas-lime is also a valuable fertilizer, and may be applied to the soil in large quantities—200 bushels per acre on pastures or meadows. If applied in this way the latter part of winter it would no doubt be valuable for destroying hibernating larvæ,

and other insects which pass the winter near the surface of the ground. When fresh it is too strong for plant growth, and if too old, unfit as an insecticide. It is probably best to let lie from four to six months, when it may be sprinkled upon various plants. It is also valuable to prevent the deposit of eggs.

The foregoing list of insecticides is certainly sufficient for all ordinary cases of insect attack, if the right one is chosen, and the application made in time. A thorough acquaintance with these remedies, and careful observance on the part of the farmer or gardner, may save him hundreds or even thousands of dollars some seasons.

AGRICULTURAL ENTOMOLOGY.

CUT-WORMS.

Order, *Lepidoptera* ; family, *Noctuidæ*. Plate I, Figs. 1 and 2.

This subject will be found treated in the address printed in Appendix "A" at the close of this report. I shall not repeat here, but add some additional thoughts and records of more recent observations.

Without doubt, this group of insects, comprising many different species, all bearing a close resemblance—has destroyed many thousand dollars worth of corn and other crops this year. Many counties, doubtless, could report a loss of a thousand dollars.

During the early season the papers were full of notices of their depredations, which were to the effect, in many cases, that half the crop was destroyed, or that corn had to be planted the second and third time to get a stand, making the crop very much later than usual.

Not only was corn thus injured, but whole fields of grass were destroyed, cabbage, tomatoes, in fact, almost all kinds of garden vegetables, tobacco plants, etc., suffered greatly. One writer says: "The damage that was done is incalculable." Their work is not confined to any one State, neither to one continent. They have long been known as injurious in many countries in Europe, a reputation which they have well sustained throughout this country of ours. It is reported in some places that they have been gathered "by the bushel." The report of the Commissioner of Agriculture for 1872 states that sixty cut-worms were taken from one hill of corn in Sullivan County, this State. However, many things have been ascribed to them, perhaps of which they are not guilty. The term cut-worm often has been

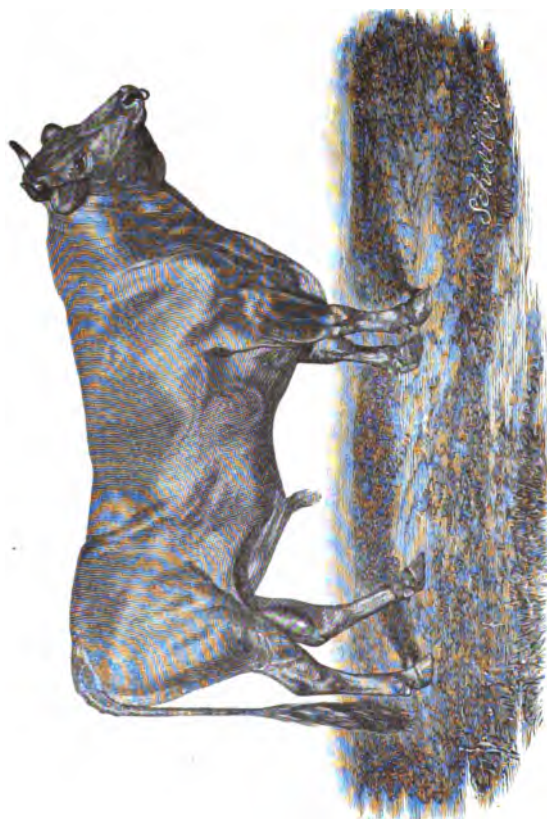
made to include several very different kinds of insects. The common white grub, much larger, and differing greatly in appearance, has borne the same title; also wire-worms, larvæ of the click, or spring beetle (*Elatridæ*); but all these are readily distinguished by a careful observer.

When full grown the cut-worm measures from an inch and a quarter to nearly two inches in length, varying with species. They have sixteen legs. The general color of their greasy-looking body is brown, gray or greenish; the head is shining, usually red or brown; there are a few scattering hairs over the body, growing from small blackish dots. There is a hard shell upon the top of the first segment. When disturbed they usually curl themselves up in a ring.

During the day they are generally found in the ground about the roots of plants, upon which they are accustomed to feed. At night they come forth from their hiding places to take food. Occasionally, in damp, cloudy weather, they may be seen feeding in the daytime. They do more damage by their habit of cutting off vegetation than by the amount they eat.

The moths, like the larvæ, are generally concealed during the day and fly at night; or, if disturbed, they fly but a short distance until they alight and conceal themselves. The general color of the moth is dirty brown or dark brown. When sitting, they fold the wings closely upon the body, somewhat in the shape of the roof of a house.

The eggs are usually deposited upon some plant near the ground, in the latter part of summer. The young worms soon hatch, enter the ground and feed upon the tender roots of various plants. At the approach of winter, they are generally about half-grown, at which time they burrow several inches into the ground, and prepare for their winter sleep by hollowing out a small oval cavity, within which they remain coiled up until the following spring, unharmed by frost, though, perhaps, frozen hard a good part of the winter in some localities. They awaken to activity with the returning warmth of springtime, and begin the attempt of satisfying their almost insatiable appetite. This is the time when they do the greatest injury, having attained to considerable size while vegetation is young and tender.



Jersey Bull, SIGNALDA (4027).

Full brother to two and sire of three 14-lb. cows, including his daughter, Signaldella.

Best test under two years of age, 18 lbs. 1 3/4 oz.

Property of CAMPBELL BROWN, Ewell Station, Tenn.

Almost every kind of plant known is liable to be eaten by them, and some even ascend trees, such as pear and apple, and eat the young buds in the spring, causing great damage. Corn, wheat, oats, cabbage, turnips, onions, beans, cotton, tobacco and most garden crops are especially palatable to them.

When full grown, they descend deeper into the ground, and change to shining, reddish-brown chrysalids, from which the moths soon emerge to spend a few short weeks and prepare for another progeny.

There are a score or more different species of cut-worms which are especially injurious, most of them belonging to the genus *Agrotis* and other closely-allied genera. These all have a general resemblance in appearance and similar habits, though some feed beneath the surface of the ground, while others climb into the branches of trees.

The period of their extensive depredations does not last long. If they should feed all summer, as the potato bug and some of the cabbage worms, their damage would be much greater. However, they work at the most critical season of the year, while vegetation is young and tender.

The length of time he spends in eating depends much upon the weather; if cool and wet, it lasts longer than when warm and dry. After entering the ground they do not always change to pupæ at once. This year many of those in my breeding jars remained coiled up in little cells in the ground all summer, taking no food whatever.

REMEDIES.

In addition to those mentioned in the Appendix, the following are worthy of consideration:

A number of birds are known to feed largely upon these pests, though on account of their eating largely after night and remaining under ground during the day, they are less liable to become food for birds than they would otherwise be.

The following birds are known to be beneficial in this respect, though some of them have rather bad records as grain

and fruit eaters: Robin, cat-bird, red-winged blackbird, and purple grackle, while chickens are especially valuable in the garden, following the plow often and gathering many a stray cut-worm, as well as other injurious insects.

Four or five species of insects in different stages, feed upon them. The toad has long been regarded as a very efficient destroyer of cut-worms. At the East Tennessee Farmers' Convention, while this topic was under consideration, one farmer said he was in the habit of gathering up toads wherever he could find them and putting them in his garden.

There are also several parasites—a half dozen or more—known to destroy cut-worms.

Among the artificial remedies which Prof. J. A. Lintner, of New York, enumerates, are to be found most of the following :

Salt. Immediately after the corn is planted, about a table-spoonful of common salt should be sprinkled upon the hill. The moisture of the ground, together with rains, dissolves the salt, and the corn taking it up in the sap, is rendered obnoxious to the worms. The salt must be applied before the corn comes up to prevent injury thereto by the salt.

Copperas. Seed corn may be put in a barrel or tub, with water enough to cover it, to which should be added a pound or more of copperas, dissolved in warm water. Stir well, and let stand a day or more. After taking it out, sprinkle a small quantity of land-plaster over it.

Hellebore is strongly recommended for protecting young tobacco plants. Use one-quarter of a pound of white hellebore to ten quarts of water. Dip the plants into the solution before setting out. The experiment has been attended with the best of success.

Coal-oil. Mix a teacupful or more of kerosene to a bucketful of sand, and scatter around tomato, cabbage, or other plants to be protected.

Late plowing is attended with good results when properly done, since the worms are thrown out when somewhat inactive,

if the weather is cool, and are thus more subject to the attack of their enemies. Also, the cells which they have formed in which to pass the winter being broken, the soil adheres to their bodies, and freezing, destroys them.

A well-known farmer of East Tennessee gives his experience in regard to late plowing in the following words:

"I have a piece of land that was last cultivated in corn fourteen years ago, since which time it has alternated with wheat, clover and grass—wheat about every third or fourth year. It was well broken last fall, perhaps the latter part of November, planted without further cultivation, about the 10th of March; another piece of land, last in corn in 1875, broken last fall also, and yet another of clover sod broken near the same time, and I do not know or remember to have noticed two dozen hills cut down by the worms in replanting the three pieces. Is not that pretty good proof that for this one reason alone fall plowing is a good panacea for these pestiferous evils that we can not otherwise control?

"In the fall of 1884, I turned a field of clover and grass sod with the same results, excepting perhaps half an acre on which I was to feed a stack of straw to cattle. This was not broken until a few days before planting, and it was literally riddled with cut-worms."

Soapsuds, Pyrethrum, paper boxes, and many other things have been tried. But perhaps the best remedy against such wholesale work as they did this last season, is fall plowing. It should be done late in the fall. If neglected then it may be done during any dry time in winter.

By a reference to Plate I, figures 1 and 2 illustrations, two of our most injurious species of cut-worms may be seen. Figure 1 represents *Agrotis messoria*, larvæ and moth. Figure 2 represents *Agrotis subgothica* with wings closed and wings expanded. Other species of cut-worms may be recognized from these, as all are similar in appearance.

THE BOLL WORM—*Heliothis armigera*, Hubner.Order, *Lepidoptera*; family, *Noctuidæ*. Plate II, Fig. 2.

I have found this insect doing no little damage in this State, both this season and last. A small plat of late corn in my garden at Loudon last year was almost totally destroyed, and this season a very early patch near the same place was also badly injured, and rendered unfit for table use. Almost every ear had from two to five well-fed worms by the time the ears were fairly formed. Later corn was not so badly injured, as the first brood of the worms had matured.

This noxious caterpillar is about as widely known and about as omnivorous as the much-talked of cut-worm, being found in nearly all the southern countries of Europe, and in most parts of our own country. It has not usually been especially injurious in this country north of about Central Illinois. Prof. J. A. Lintner states that it first appeared in New York as an injurious insect in 1882. It is chiefly in the Southern States that great injury is done:

While it attacks a large number of crops, including tomatoes, peas, beans, hemp, tobacco, strawberries, etc., it is especially destructive to corn and cotton, and in consequence is known by the two names, "Corn" or "Boll" worm. Let us consider it first as a

"CORN WORM."

It is thought that this insect destroyed more than forty thousand bushels of corn in a single county of Kansas in 1860; and this county was but a fair sample of the entire State. In 1881 great damage was done even as far north as Michigan.

The eggs of the first brood are probably laid on the blades of the corn. I noticed the upper blades had numerous holes in them. They bore through the sheath inclosing the tassels; and half-grown worms may be found in the tassels that are scarcely yet out. Eggs are also laid upon the silks of the corn, and the young worms hatching first feed upon the tender silks and later attack the ear, eating galleries about the cob, sometimes following a single row.

It may be found during the entire season, till the late corn becomes hard ; and they even feed upon corn dry enough to crib, though they seem to prefer the corn while in the milk.

The damage the worm does is not measured by the amount of corn eaten. An ear, though eaten but little, often mildews and decays, especially if the weather be rainy. Other insects also collect upon the injured ear, and help to complete the work. The milk from the corn sometimes flows out and renders it unsightly in appearance. When almost every ear is eaten into, as sometimes happens, the crop is about worthless.

Considering it now as a

BOLL-WORM,

we find it no less injurious to cotton than to corn. The eggs are placed upon the leaves of the cotton either above or below, more often below, and each moth will deposit about five hundred. The little caterpillars first feed upon the leaves, but later they eat into the flower buds, eating out the interior, causing the buds to fall. However, before the bud falls the caterpillar forsakes it and enters another, and in this way may destroy several buds. Later they eat into and destroy the bolls.

This boll worm seems to be more injurious to cotton than even the cotton worm (*Aletia argillacea*). One county in Texas reported* in 1880 that the cotton crop was so badly injured by the boll-worm that they did not attempt to save it. Another county reported four-fifths of the crop destroyed. Another reported 75 per cent. destroyed. Another reported 50 per cent. lost. In one case 250 acres of cotton was sold for \$250, on account of the injuries of the boll worm.

DESCRIPTION AND NATURAL HISTORY.

In the extreme south there are five broods each year, the first three usually living on corn, and the last two upon cotton. In this part of Tennessee where little or no cotton is grown, there

* Report 4, U. S. Entomological Commission, p. 355.

are about three broods only, while in States farther north only two broods are found.

The eggs are almost white, seven m m. in diameter, and are placed almost any place upon the cotton plant. A single female is capable of depositing as many as 500 eggs.

The larva at first resembles the young cotton worm. The colors are pale, the head large, hairs long and stiff. When full grown there is great variation in coloring, from dark brown to light green. Their markings also vary greatly, some having the marks and stripes almost invisible, others having them distinct. They are usually marked with a dorsal stripe, also a lateral and a sub-dorsal stripe on each side. The full grown worm is a little more than an inch and a half long.

Having attained their full size, the worms enter the ground, sometimes forming a tube or channel by cementing the walls, in which they pupate. They remain in this stage in summer from seven to ten days. Earlier or later in the season they remain in the ground a longer period, while the last brood passes the winter in this manner.

The pupa is four-fifths of an inch long, of a light mahogany-brown color, and is marked with numerous punctures.

The imago, or moth, varies greatly as does the larvæ. The color ranges from dull ochre-yellow to dull olive-green. In some individuals the markings of the front wings are very faint. The hind wings usually show distinctly a broad, dusky band on the hinder margin. The front wings each have a dark spot near the middle.

When at rest, the moth holds its wings slightly elevated, exposing the abdomen, also showing the hind wings. It may thus be distinguished from the cotton moth, *Aletia*, which folds its wings closely over the body, the hind wings being entirely covered by the front ones.

NATURAL ENEMIES.

Some of the bats in the Southern States are known to catch the moths while on the wing at night. Poultry are often very

bénéficial, and will hunt through cotton fields for the worm. A number of birds have been known to feed upon them. A large number of precocious insects devour them, and the list of enemies is still further augmented by several internal parasites.

REMEDIES.

Hand-picking, especially for the earlier broods, may be adopted with excellent results; and each moth of the first brood destroyed may decrease the number that would otherwise appear during one season by many thousands, since each female is capable of depositing five hundred eggs, and there are four or five broods. They may be gathered from tassels of corn, or from the ear (where their appearance may be determined by the appearance of the silks), by turning back the husks at the end. For this purpose a pair of strong, pointed nippers would be useful in reaching them without turning back the husks very far.

The moths may also be attracted by the odor of vinegar and molasses, placed in plates or other vessels situated at convenient distances throughout the field, especially in cotton. Into these they will fall and be drowned. This has been tried with good results. The plates should be placed upon stakes a little above the height of the cotton. They may also be attracted by lights placed upon stakes above vessels containing water, with a little kerosene added to float upon the top of the water. In seeking the light they will fall into the vessel and perish.

On account of their manner of feeding within the bolls, or under the husks of corn, it is somewhat difficult to reach them with poisons, but experiments have shown that many may be killed in cotton fields by spraying with Pyrethrum, as for destroying the cotton worm.

The worms are sometimes carnivorous in their habits, and eat each other very greedily. This is especially true in confinement, when the stronger are sure to destroy the weaker. The writer has seen a large one eat two smaller ones without stopping, the victims wriggling and writhing until almost entirely consumed.

THE COTTON WORM—*Aletia xyliana*, Say.Order, *Lepidoptera*; family, *Noctuidæ*.

This well-known enemy of the cotton-grower sometimes causes an annual loss, throughout the cotton-growing States, of nearly thirty million dollars. The average annual loss is estimated* at about \$15,000,000 for all the cotton-growing States for the first fourteen years following the war. In years of greatest severity the loss to the cotton-growers of this State is put as high as \$418,000. The table of the losses for 1881 shows that Tennessee was injured to the amount of \$146,150. The decrease in later years is probably due to the more general application of poisons. * * * * Though this worm has been known in this country for three-quarters of a century, very little was known of its habits until a few years ago. Most of our definite knowledge of the insect has been gleaned in the last decade.

The eggs which produce this worm are bluish-green in color, and are laid on the under side of the leaves in April and May for the first brood.

The worm when first hatched is a dingy yellow color, dotted with polished black spots. For some time the worm feeds entirely on the under side of the leaves.

When full grown it spins a slight cocoon, in which to pupate. Some authorities state that it also sometimes descends into the ground to transform, but Prof. Riley says not.

The moth measures from $1\frac{1}{8}$ to $1\frac{1}{2}$ inches from tip to tip of the wings when spread. It is somewhat of a yellow or golden color, having crimson lines across the front wings and a dark, oval spot on each. The under side is gray.

It flies by night, and the eggs are deposited in the latter part of the night. A single moth is capable of depositing six or seven hundred eggs.

* See Report 4, United States Entomological Commission, page 3.

The broods follow each other in quick succession from the last of April till frost, and there are not less than seven different broods a year.

NATURAL ENEMIES.

The following vertebrate animals are known to feed upon these insects in some of their stages, to a greater or less extent: The hog, raccoon, skunk, opossum, lizard, etc. Also birds, including all domestic fowls and prairie chickens, quails, the thrush, cuckoo, blue-bird cardinal gross-beak, mocking-bird, blue-jay, red-winged black-bird, rice-bird, kildeer, plover, bee-martin or king-bird, indigo bird, nonpareil, orioles, barn-swallow, Southern shrike, sparrows, wild turkey, etc.

Of the invertebrate animals may be mentioned a large number of insects, including wasps, ants, beetles of various kinds, half-winged bugs, flies, mantis, etc., etc. A large number of internal parasites have been bred and described.

REMEDIES.

Some of the same remedies used in destroying the boll-worm, treated in the preceding article are also employed against this worm. The moths may be attracted by lights and destroyed, or killed by various sweetened fluids poisoned with different substances as arsenic, Paris green, etc.

A large number of insecticides have been employed in killing the cotton worms by spraying or dusting upon them. Among these are the following: Paris green, arsenic, London purple, kerosene emulsion, gas-tar water, pyrethrum, etc. For mode of preparation, see introduction to this report. Hence, for applying these various insecticides a great many contrivances have been invented; but a complete description of the more important of these even cannot be given in so brief a report as this must be. In the chapter on insecticides in the introduction to this report, various force pumps for throwing a spray upon trees, etc., are noticed; but these are scarcely suitable or adequate for the cotton field. Divers kinds of nozzles are made which may be attached to these pumps or other device used.

There are scores of other machines figured and described in the United States Entomological Reports, and Reports of the United States Entomological Commission. Any one desiring to apply insecticides on a large scale will do well to get some of these reports.

THE GRAIN WEEVIL—*Bruchus granarius*, Linn.

Order, *Coleoptera*; family, *Bruchidæ*.

This small weevil is very similar in appearance and habits to the bean weevil (*Bruchus obsoletus*). It is less than one-eighth of an inch in length. The wing cases are brownish in color; there is a white patch on the thorax, and the tip of abdomen, extending beyond the wing cases, is white.

This is a European insect, but was imported into this country many years ago. In its native haunts it is very injurious. Curtis, in his work on Farm Insects, gives the following account of its habits in Europe:

“It is said that the female beetles select the finest peas to deposit their eggs in, and sometimes they infest crops to such an extent that they are eaten up by them—little more than the husks being left. The various kinds of beans are equally subject to their inroads; besides the long pods I have alluded to, I have had broad Windsor beans sent to me containing these *bruchus*; and Mr. C. Parsons transmitted me some horse beans in the beginning of August, 1842, which were entirely destroyed by them. Mr. F. J. Graham showed me some seed-beans which were inoculated by these beetles to a great extent, and some of them were alive in the seeds; yet, to any one ignorant of the economy of this pest, there would not appear the slightest external indications of their operations. I also received from a gentleman residing in Norfolk, a sample of seed-beans from Russia, for winter sowing, a large proportion of which were perforated by this *bruchus*.

“It has already been intimated that as the beetles generally leave the germ uninjured, the vitality of infested seeds is not destroyed. I doubt, however, if they produce strong, healthy

plants ; and, from my own experience, I have no doubt if peas and beans be sown, containing the *bruchus granarius*, that the beetles will hatch in the ground, and thus the cultivator will entail upon himself a succession of diseased pea and bean crops. Now, to avoid this loss, the seed should be examined before sowing, when, to an experienced eye, the presence of these beetles will be discernible, where to a common observer they would appear sound and good. The maggots, when arrived at their full size, gnawing a circular hole to the husk or skin of the seed, whether pea or bean, and even cut around the inner surface which covers the aperture, so that a slight pressure from within will force this lid off; these spots are of a different color to the rest of the seed, generally having a less opaque appearance, and often are of a duller tint; on picking off this little lid, a cavity will be found beneath, containing either a maggot, pupa, or beetle."

One writer has said : " It would be a sad misfortune to have this insect added to our list of injurious species."

It has not been considered injurious in this country. I have seen no account of any injuries caused by it, yet I am able to report it as being *very* injurious in this State. From a recent examination of the peas found in market at Loudon, I found, by actual count, gathering them up by the handful, that ninety-six per cent. of the peas were injured, and many of them burrowed in such a manner as to destroy nearly the entire substance of the seed. Most of these perhaps will grow, if planted, as shown in the quotation from Curtis; but of what use are they, if the crop produced has only four sound peas out of a hundred? I do not know how general such destruction is throughout the State.

This species must not be confounded with the common pea weevil (*Bruchus pisi*)—see Plate II, Fig. 4—which is a much larger species; but it will never be so injurious, since of the latter there is only one to each pea, while of the former there are sometimes half a dozen in a single pea.

REMEDIES.

As soon as gathered the peas should be placed in a tight box, into which put camphor or bisulphate of carbon, or some

other substance the odor of which will permeate the entire lot, and thus destroy all the weevils. This may not prove entirely effectual, since some of the beetles are likely to escape before the peas are thus put up.

It has usually been considered sufficient to inclose the peas in a close vessel, without any camphor or other substance, and it is stated the weevils will all die before planting time. I have found that this is not true. I am convinced by my observations this season that not more than half the beetles come out of the peas before planting time. In less than a pint of peas, grown the year before, which were kept in a close vessel until the first of September this last season—nearly a year—I found *scores of live beetles*, seemingly as active as if they had just come forth. In fact, many did come out through July and August.

If the vessel containing the peas had been previously saturated with kerosene, the beetles will likely be killed by the odor, or by coming in contact with the walls of the vessel.

PARASITES.

No parasites have hitherto been reported as destroying this species, although these are known in Europe. I am glad to be able to report at least one parasite, bred this season—a small black, four-winged fly, about eight-hundredths of an inch in length. This is not only economically new, but seems to be an undescribed species. Unluckily, all the specimens I had were almost entirely destroyed. Mr. L. O. Howard, of Washington, a specialist in this line of investigation, says that it is a *Pteromalid*, and probably undescribed; but it could not be determined, owing to its condition. I hope soon to obtain fresh specimens, and describe it, if new.

THE BEAN WEEVIL—*Bruchus absoletus*, Say.

Order, *Coleoptera*; family, *Bruchidae*.

This little beetle, which has been known to be injurious to the bean crop in some parts of the country for about twenty-five years, has done no little damage in this State during the

last two seasons. The perfect insect is scarcely more than one-tenth of an inch in length. The general color is brownish or gray, the body being covered with a slight down or pubescence. Sometimes several larvæ (which are similar to the larvæ of the well-known pea weevil) may be found in the same bean.

The larva, on coming to maturity, eats a small round hole almost to the surface of the bean, leaving only the outer skin. Then it transforms to a light brown or reddish pupa, differing from each other considerably in general color, and about the size of the perfect beetle. Some of these pupæ transform and escape in the fall, as has been said; others come to maturity in the fall, but do not leave the bean; while others do not complete their transformations till the following spring.

These beetles are capable of doing a great deal of injury, and many of those found in the market last season contained from one to half a dozen or more of the pests. Of those examined, by actual count of a number of the beans gathered up by the handful, 16 per cent. were found to be injured.

They did great damage in Loudon County, and were reported as doing serious injury in this (Greene) County.

They sometimes escape detection by the cook, and are served up at dinner incased within the bean. Especially will this be likely to occur with any except the very light colored varieties. Larvæ or pupæ thus eaten would not cause any serious results; but most of us prefer other diet. However, the infested beans may usually be detected by the bluish spots caused by their eating holes to the skin.

Those that are badly infested will generally float when put in water; but this test cannot be relied upon for table use.

Beans infested by this weevil will germinate when planted, even when almost the entire inside is eaten out, since the vital part of the bean is left untouched; but in such case, only weakly, sickly plants will be produced.

There are several remedies which may be applied. The beans may be heated by immersing in hot water, or placing in a hot oven for a short time. They may also be inclosed in a tight

box with camphor or bisulphate of carbon, with good results, as in the case of the previously described species, *Bruchus granarius*. If the inside of the vessel or box used be saturated with coal-oil, the beetles will be killed, as those who have tried it testify.

THE PEA WEEVIL—*Bruchus pisi*, Linn.

Order, *Coleoptera*; family, *Bruchidæ*. Plate II, Fig. 4.

This little beetle is found almost everywhere in this country, but is not so destructive as the Bean weevil and Grain weevil, since only one of the Pea weevils is found in each pea. This species is considerably larger than either of the other two mentioned. It is about one-eighth of an inch long, rusty-black in color. The tip of the abdomen is white, having two black spots. Each wing case has two white bands extending across it; the one farthest back is the more distinct. The markings are very well shown in the illustration.

As soon as the peas begin to form in the pod, the female deposits her small yellow eggs, not more than one-thirtieth of an inch in length, upon the pod. The larva which hatches from this egg bores directly through the pod into the young pea, where it feeds and undergoes its transformations. The germ of the pea is left untouched, hence it will still grow. When the larva has become full grown it gnaws a circular hole to the surface of the pea, leaving only the thin hull, through which the imago readily escapes.

REMEDIES.

The remedies for this weevil are the same as for the two other species of the same family previously described, viz, inclosing the infested peas in a close box with camphor or other substance, or keeping them over till a second year in a close vessel; or, the beetles may be killed by heating the peas in an oven, or by steam or hot water.

THE SQUASH-VINE BORER—*Melittia cucurbita*, Harris.

Order, *Lepidoptera*; family, *Ægeriadae*.

About the middle of July County Superintendent of Schools J. A. Lane, of Loudon County, informed me that a large white worm was doing great damage to the watermelon crop in his vicinity by boring into the vines, and the farmers wanted some information in regard to the matter. No specimens were sent me, but from his description I am confident it was the squash-vine borer. No complaints came to me from other parts of the country, and I noticed none of the worms on watermelon vines about Loudon, the county-seat, though, owing to the excessive rains at that time, I could make but few examinations. However, from a kind of gourd-vine growing in a back yard, I took more than half a dozen nearly grown larvæ of this borer. A limited search among other vines in the vicinity failed to reveal any other depredations. Since this insect often causes great injury to squash, melon and pumpkin vines, no doubt it will be found in injurious numbers in other parts of the State.

This offender seems to direct its attention chiefly to squashes, and especially the Hubbard variety. A New York correspondent to the *Country Gentleman*, quoted by Prof. J. A. Lintner in his second report as State Entomologist of New York, states that he took from one vine during the season *one hundred and forty-two borers*, and though he spent \$100 in labor trying to save the crop, all was lost.

The full-grown larva is an inch or more in length, soft and fleshy. The rings or segments are distinct; the body is thickest in the middle, tapering to each extremity. The head is small, brown, and has a V-like mark on it. The first segment behind the head has two oblique brown marks converging behind. There is a pale dorsal line visible from the fourth to the tenth segments. The remainder of the body is white. It has six true legs. The soft pro-legs, which caterpillars usually have, are wanting, but instead there are one or two rows of hooks on each segment.

When the worm has finished feeding, it leaves the vine and descends into the ground a short distance, forming a slight

cocoon, in which it undergoes its transformations. It is possible the caterpillar sometimes spins its cocoon above ground; but if at all, only occasionally this occurs. Prof. Lintner says that the larvæ enter the ground about the first of September in New York. He also states that in the Southern States the more advanced larvæ form their cocoons as early as August. However, I find that they are more advanced than that here; for all the worms I had taken entered the ground before July 15, except one which was injured, and an examination of the vines at hand revealed many empty burrows, but not a single borer. The excessive rains prevented my making as extensive examinations as I should like.

The worms, after entering the ground, do not at once change the pupæ, as was formerly supposed, but according to more recent observations they usually remain in the larval stage through the winter, coming forth as moths in this climate perhaps in the earlier part of June.

There is some variation in the marking of the moth. The body is usually orange-colored, spotted with black. The hind legs have a long orange-colored and black fringe of hairs. The wings expand one and one-fourth inches. The front wings are olive-brown, the hind wings are transparent.

This moth belongs to the same group of insects in which are found the peach-borer (*Ægeria exitiosa*), which does great injury in this State; also, the currant-stem borer (*Ægeria tipuliformis*), all of which have wings more or less transparent and are somewhat wasp-like in appearance.

REMEDIES.

Among the many remedies which have been tried, the following have proved serviceable:

Cutting out the Larvæ. The place of attack is readily found, and with the point of a pen-knife the vine may be quickly split and the worms removed. If they are very numerous, and the crop of vines large, this method is not very satisfactory, though until recently the only one known.

Rooting the Plants at the Joints. This seems to have proven very effectual. Cover the vines at the joints, and if the ground is fertile they will readily take root. The original root may then be cut off if infested, without injuring the vine.

Plowing the Ground after the crop is harvested, followed by thorough harrowing, is recommended by Professor Lintner as a very effectual method. The larvæ will be thrown up and crushed, or sufficiently injured to prevent development.

Gas-lime, thoroughly distributed over the ground after the crop is removed, is also recommended as efficient in killing the larvæ in the ground.

Paris Green. If the vines are thoroughly wet with Paris green water occasionally, before and after the borers make their appearance early in the season, the young larvæ will be killed when they begin to eat into the vines.

Soap Emulsion and Coal-tar are valuable for preventing the moth from depositing her eggs on the vines.

Do not plant two consecutive crops in the same place.

STRIPED CUCUMBER BEETLE—*Diabrotica vittata*, Fabr.

Order, *Coleoptera*; family, *Chrysomelidæ*. Plate I, Figs. 7 and 8.

Numerous complaints have been made to me this year of the ravages of the striped cucumber beetle, especially in Loudon County, where they were very numerous upon watermelon and cucumber vines. They were to be found upon the vines almost during the entire summer. I doubt not they were equally destructive in other parts of the State.

During its larval, or grub, stage, this insect does no small injury by boring into the roots and lower part of the stem of the same plants upon which the beetle feeds. The parent beetle deposits her eggs about the roots of vines early in the season. From these small, slender grubs are hatched, which are about a third of an inch long, and not thicker than a knitting needle. These, as before stated, bore into the roots and vines; reaching the pupa state in about a month, it enters the ground to pupate.

In about two weeks the mature beetles emerge. These are about one-fourth of an inch long; thorax is yellow; the elytra, or wing cases, are pale-yellow, having a broad black stripe along the middle of each, reaching nearly to the tip, and another down the suture, partly upon each elytron; also a narrow black border around the outer edge of each.

REMEDIES.

As the chief damage is done while the vines are very small, one of the best remedies is to cover the vines with something. This may be done by using small boxes with musquito netting tacked over them. They may also be covered with paper, weighted down with small stones, clods or sticks. But after a heavy rain the papers will need to be replaced with others. Cotton-batting has also been recommended. It is drawn out in a thin film, and held in place as the paper. It is preferable to paper, since it admits the air freely. This, too, will need re-adjusting after heavy rains.

The beetles may be destroyed by dusting with Paris green mixed with flour, or by spraying them with Paris green water. Other insecticides may be used in the same way. See directions for using in the Introduction to this Report. Prof. A. J. Cook, of Michigan, recommends strong soapsuds, to seventy-five parts of which one part of carbolic acid is added. Apply by spraying.

THE LESSER MIGRATORY LOCUST—*Caloptenus atlantis*, Riley.

Order, *Orthoptera*; family, *Acrididae*.

The following communication from "T. B. W.," Wales, Tenn., appeared in the *Spirit of the Farm* August 4th:

"Grasshoppers have several years been very damaging to crops in this neighborhood, especially on farms where clover and other grasses are grown extensively. Do you know of any practical way of destroying or getting rid of them? I was damaged not less than \$3,000 last year, and fear a repeti-

tion this year. If you know of any agent or means for getting rid of them, please let me hear from you without delay. The young grasshoppers will soon have full-grown wings, and then it will be impossible, I fear, to do anything with them."

A number of years ago, grasshoppers, or locusts, were very destructive in this State at one time, but I have heard of no such serious losses occasioned by them recently, like the instance above. They were reported a few times early in the season through the monthly crop reports issued by the Commissioner as injurious to tobacco plants and other young crops. One or two species of true grasshoppers are to be found often upon the growing tobacco in this part of the State, but the damage done is slight, and the offender is an entirely different one. The insect of which "T. B. W." writes is no doubt the Lesser Migratory Locust (*Caloptenus atlantis*, Riley), very closely related to the Rocky Mountain Locust and our common red-legged locust.

There are numerous devices for destroying the locusts, many of which have been described in several of Riley's Missouri Reports, and the Reports of the United States Entomologist. To discuss all these much space would be required. One of these, called the Riley Locust Catcher, is figured in the Report of the United States Entomologist for 1883, and described in the following language :

"It is briefly, a large canvas bag stretched upon a light but strong frame, and placed upon runners, which extend with curved tips a little in front of the mouth. The canvas is stretched upon the inside of the frame, thus making the bag smooth and even within. This bag has a mouth ten feet long, and two feet high, and converges backward to a small box or frame, one foot square, with a slide cut-off. This box forms the mouth to a secondary bag, two and a half feet long and one foot in diameter, which ends in a second frame having two short runners below it. There is a sliding door of wire gauze in the end frame, and the secondary bag is stretched by a couple of strips of leather connecting the two small frames. The machine is made to take more land by means of two right-angle

triangular wings about six feet long that hinge to the upright ends of the large frame, in such manner that the rectangle joins the upper corner of the frame. From the lower side of this wing are suspended a number of teeth or beaters, which, swinging loosely, drive the locusts inward. The machine is handled by means of two ropes hitched to the outer runners, or to the outer and lower side of the mouth of the frame."

This can be handled by men or by a horse. The locusts hopping into this machine pass back into the smaller bag (made of light colored material, while the rest should be dark), when they may be taken out through the slide door and buried. The winged locusts as well as the young are caught, if operated in the cool of the morning or evening. The machine can be made for about \$10 or less.

Other machines are made having a trough containing coal-oil, or canvas saturated with coal-oil. Others are made for crushing them between rollers.

Prof Riley states that with one of these machines on one occasion fifteen bushels of locusts were gathered in one hour, and at other times a bushel was taken in two minutes, and in another field containing four acres thirty-six bushels were taken in two days.

Those interested may be able to secure a report giving a lengthy discussion of the subject by applying to the Commissioner of Agriculture, or Prof. C. V. Riley, Washington, D. C. Space could scarcely be given in a brief report like this to properly present the subject; and it cannot be well done without costly illustrations. Serious outbreaks do not seem to be general or of usual occurrence. For protecting small plants from their depredations in a small way, the various insecticides, as Paris green, London purple, Pyrethrum, kerosene emulsion, etc., may be resorted to.

A correspondent to the *Spirit of the Farm* mentions a farmer who raises a large number of turkeys—from one to five hundred a year, and these always clear his fields of grasshoppers.

THE HESSIAN FLY—*Cecidomyia destructor*, Say.

Order, *Diptera*; family, *Cecidomyiidae*. Plate III; Plate IV, Fig. 3.

This enemy of the wheat has not been so destructive this season as at some other times. But two or three counties have reported the insect this summer through the Commissioner's monthly crop reports, and but little has been said about it through the agricultural press of the State; but a few years ago it was supposed to have destroyed one-tenth of the entire wheat crop of the State. Our sense of security may be but the harbinger of greater losses. In time of peace we sometimes forget to prepare for war. If we neglect to take the proper precautions, and to apply the proper remedies, we may look for a fresh outbreak. Other States have not been so fortunate as ours. It is estimated that New York lost \$100,000 by this insect during 1885. The large wheat fields of the West sustained even greater injuries.

Although this is a very common insect, much written about and talked about, yet few of our farmers are really familiar with the insect in all its stages, or with their method of attack.

The eggs are laid in the fall upon young wheat, from which, in a few days, the young larvæ are hatched which are to produce the next year's brood. They make their way downward under the sheath near the ground, where they remain till they reach the flaxseed, or pupa stage, from which the adult flies finally emerge.

An enlarged view of the insect, in its various stages, is given in the Plate. For fuller mention of these various parts, see Explanation to Plates. Further description is not necessary.

REMEDIES.

Late sowing has been considered one of the best remedies. Some have recommended sowing a small plat as a decoy, which late in the season should be plowed under to destroy the young maggots.

The following from the pen of Prof. S. A. Forbes, State Entomologist of Illinois, will be found interesting and valuable:

"From our own observations and collections of the last three years, and from information contributed by very intelligent correspondents who have spent years in the midst of the Hessian fly, I infer the strong probability of two important items in the life-history of the species: (1) The emergence as imagos before harvest of a great part, if not most, of the spring brood of the larvæ; (2) the development of an additional brood in volunteer wheat, the flies of which appear in autumn early enough to deposit their eggs and produce a third brood of larvæ before the advent of winter. These facts suggest the possibility of greatly checking, if not practically arresting, the multiplication of the Hessian fly in our latitudes by the following simple procedure: According to the best agricultural practice, the stubble is plowed for wheat immediately after harvest. In case there has been little or no shelling out of the grain in the field, a little may be sown before plowing, so that enough may grow, either of the volunteer wheat or the grain thus sown, to tempt all the flies then abroad to deposit their eggs early in the season. Previous to sowing the wheat for a crop (and this may now be done early to advantage), this young wheat should, of course, be killed by a rotary harrow, or some similar instrument, in which case, if this action be intelligently timed, all the young or half-grown larvæ in this growing grain will, of course, be destroyed. If such procedure were general throughout a neighborhood, there seems very good reason to suppose that a vast number of the flies must inevitably be destroyed, only those remaining which had not emerged in time to deposit their eggs before this final sowing of the fields—a percentage probably too small to do serious mischief.

"My information is also to the effect that wheat sown in the latter part of August is much less liable in Southern Illinois to be seriously damaged by the fly than late sown fields. In the early sown grain the larvæ transform and the flies emerge before winter, the wheat having time before its growth is arrested by the season's cold to rally, by tillering against the damage done. Late sown wheat, on the other hand, if attacked by the fly, is certain to be seriously damaged, because it has no opportunity to recuperate, and whether attacked by the fly or not, is extremely likely to be killed by the winter. It is not an un-

common thing in Southern Illinois, in seasons not specially remarkable for severity, for 50 per cent. or more of the winter wheat to be winter-killed as a consequence of the late date at which it was sown in the hope of protecting it against the fly."

Burning the stubble is also recommended, especially when cut high; if cut low, many of the undeveloped flies will be deposited in the stock with the straw, and perish there, since they will be unable to get out.

THE EUROPEAN CABBAGE WORM—*Pieris rapæ*, Linn.

Plate I, Figs. 4, 5 and 6.

This destructive worm is treated in the address, Appendix "A." I shall take space here for a few observations of later date.

During the entire summer the worms were very injurious about Loudon. I had had some correspondence with Prof. S. A. Forbes, State Entomologist of Illinois, in regard to introducing into this State a contagious disease, or plague, which has almost destroyed this pest in Illinois and other other States.

Having moved to Greeneville about the middle of September, when about to make final arrangements with Prof. Forbes to come to this State to try the experiment, I made an examination of many cabbage-patches in and about town to ascertain whether the worms were already free from the disease, but I found there was scarcely a worm to be found in the country.

In correspondence with Miss Beulah Greer and Mr. S. R. Rodgers, two budding entomologists of Loudon, I learned they were also very scarce there. No dead ones were found either there or here, and I do not think we have any reason to believe the disease has yet appeared in this State. My brother, D. W. Doran, A. M., Principal of Edwards' Academy, White Pine, Tenn., sent me numerous specimens at the same time, which seemed in healthful condition, and changed to pupæ. He found no dead ones. The scarcity is no doubt due to the lateness of the season and to parasites. I should be glad, for the sake of cabbage-growers, that I might report the disease here, as in some other States, where such good results have followed.

I hope next season to carry out this experiment, which, if successful, will save many thousand dollars to the cabbage-growers of this State.

This important crop has almost become a failure in many places, on account of many pests which feed upon it, and unless something is done to check their depredations soon, we may as well give up attempting to grow cabbage.

THE CABBAGE PIONEA—*Pionea rimosalis*, Guen.

Order, *Lepidoptera*; family, *Pyralidæ*.

Of the thirty or more different insects known to injure the cabbage, none seem to be doing so much injury to this esculent in this part of the State as the Cabbage Pionea. Its manner of feeding—boring into the heads—often remaining entirely concealed from view, renders this pest more destructive than the imported cabbage worm (*Pieris rapæ*, Linn.) treated of in the preceding article, even when they are to be found in equal numbers; but the Pionea seems to have the advantage in that respect here.

This is comparatively a new feeder. Dr. Cyrus Thomas, former State Entomologist of Illinois, was the first to report its attack upon cabbage, which was in the fall of 1879. It seems to be rather a southern insect. It was to be found here last season in great numbers, though it does not appear so early in the season as the common green or imported cabbage worm.

LIFE-HISTORY AND DESCRIPTION.

The eggs are laid in clusters of twenty or thirty, forming a flattened, circular ground. They are oblong, light-yellow, about .04 inch in length. *The larva* in its earliest stages is very light in color and faintly marked. When full grown, the larvæ are six or seven tenths of an inch long, slightly flattened; head light-brown or greenish. There is a broad whitish band along the back, consisting of numerous white and purple transverse lines. Just below this band is a subdorsal line of purple, and below this a line of yellow, which extends to the stomata or breathing

pores. There are several small black warts or tubercles on each segment, and the body is sparsely covered with black hairs. The pupa is nearly half an inch long, brown or yellowish-brown. The place of pupation does not seem well settled by those who have written upon the subject. Dr. Thomas says that those in his breeding cages pupated on top of the ground, forming very slight silky covering, interwoven with sand. Prof. C. V. Riley states, in the United States Entomological Reports for 1883, that his specimens pupated on top of the ground without any cocoon or covering of any kind, which, as he says is probably abnormal. I have had the same experience with other caterpillars which are known to enter the earth under ordinary circumstances. Supposing this question had been thoroughly studied by others, I have not made extensive observations; but I think neither of the above situations for pupating is correct in the normal state. I have found them neither on top of the ground nor near the surface.

The moth expands nearly an inch, having a slender body, about half an inch long. The general color of the first pair of wings is pale ochre-yellow, shaded with brown. The color of the secondaries is pale-yellow, transparent, having a copper luster.

The larvæ eat elongated holes through the leaf, sometimes eating everything but the mid rib and larger veins. As before stated, they also bore into the heads, or feed under the folds of the leaves so that they are not readily seen. A few of the worms will soon destroy a small head by preventing its development.

REMEDIES.

Dr. Thomas found no parasites upon this insect; but Professor Riley bred two different species. I have not yet made any observations in that respect. I made one application of pyrethrum, one or two tablespoonfuls to a bucket of water. (If fresh and good, one tablespoonful is sufficient.) Within five minutes after they were sprayed, the worms were crawling in all directions; in a few minutes more some had fallen to the ground, and were rolling about as in great agony. Fifteen hours after, when examined again, all were dead, except a few

which had not been reached by the liquid. This is certainly sufficient, if applied in season, to thoroughly protect the cabbage.

THE PEACH BORER—*Egeria exitiosa*, Say.

Order, *Lepidoptera*; family, *Egeriæ*.

Among the almost innumerable pests with which the orchardist has to contend, the Peach Borer holds a prominent position. It seems to be a denizen of all counties, and is everywhere recognized as an inveterate enemy to the peach-grower. Our State has been no exception. Mr. A. W. Ward, a nurseryman at Loudon, Loudon County, reports it as one of the two most injurious enemies to his nursery stock. (The other is the apple-root plant louse, elsewhere noticed in this Report).

A White County correspondent to the *Spirit of the Farm*, signing himself "J. W. F.," has the following to say of that insect, in the issue of March 3, 1886:

"I have been much pleased with the instruction given us by Prof. Doran, on entomology.

"There is one kind of insect, however, he has not as yet discussed, which has done as much damage as all the others spoken of by him; notwithstanding the damage done by the latter ranges up amongst the millions, and that, too, sometimes in one year.

"When we were boys, some thirty-five or forty years ago, don't you know that the planting out of a peach orchard was considered a work of supererogation—an expenditure of time, labor and soil, wholly unnecessary? And why? Because this (Tennessee) seemed to be the normal soil and climate for the peach; and hence, the seeds scattered in the corners of the fences, around the farm, about the garden and horse-lots, yard and cow-lots, etc., sprang up spontaneously, and bore most prolifically, and there being no railroads, we had all of this most delicious fruit we could eat, make pot-pies out of, and dry for family use until it come again on the ensuing year.

"The great abundance of this fruit, and the ease with which it was produced, led us to deprecate this most delicious and healthful of all fruits. But what has been the fate of the fruit for the last several years? There is an infernal pest, known as the Peach Borer, which has become a complete bane to the health and production of this tree. On account of the inordinate appetite of the writer for peaches, which he looks upon as the superior of all fruits, in every respect, and its value for eating or canning purposes is superior to all others, we cannot do too much for its preservation."

The moth deposits the eggs during the summer upon the trunk of the tree, usually near the root, from which hatch the borers that at first penetrate the bark, and devour the inner bark and sap-wood, but afterward bore deeper into the wood. The situation of the boring may be detected by the gum which exudes from the holes in the tree. This grub is about half an inch long, of a whitish color, the head being reddish-yellow, and has sixteen legs. They live in the tree almost a year before they change to the inactive pupa stage. Though there is but one brood a year, there may be found several sizes of the caterpillars in the tree at the same time.

When ready to change to pupæ, they form cocoons, either under the bark of the tree, or at the root, or in the earth and gum about the roots. From June to August escape the moths, which are slender, dark-blue, and somewhat wasp-like in appearance. The male and female differ very much from each other in size and markings. The male, which is the smaller, has all the wings transparent, and bordered with blue, and its wings expand about one inch. The female expands one and a half inches, the hind wings only are transparent, and the abdomen has a broad orange-colored belt. The general color of both is steel-blue.

It is reported that they sometimes deposit their eggs upon the cherry-tree and plum-tree, and also in the crotch of the branches of the peach-tree, instead of their roots; in which case the damage is very much lessened.

REMEDIES.

A number have been used. Remove the earth from around the base of the tree, destroy the cocoons and borers which may be found in the ground and under the bark, surround the tree with a strip of paper eight or nine inches wide, extending below the level of the soil an inch or two, then fill around with fresh earth. Raise a mound about the tree a foot high, then add a few inches of soil for several succeeding years. Some claim that the mounding should not be done till the trees are four years old. Ashes and lime thrown about the tree, or filled in after the soil has been removed, will be found serviceable. Tobacco stems thrown about the roots may also be effectual in keeping the moths from depositing their eggs. The mounds are raised for this purpose; for, since the eggs are usually deposited about the roots, if they are covered up deeply, the moth cannot get to them, and cannot deposit otherwise. The mound will work no injury to the tree, but rather will be a benefit.

Some argue that the cost and trouble of mounding a tree render this remedy impracticable; but it is claimed that one man can mound fifty trees in a day, hence the cost per tree is very little.

Hot water may also be applied after the soil is removed. It should be applied copiously, and almost boiling hot. The knife should also be freely used, especially on young trees, in cutting out the offenders while just under the bark.

Prof. A. J. Cook, of Michigan, gives the following remedies:

The sure way to destroy these harmful borers is to dig them out in September, and again in April or May. In September, because, if left later, they will do much damage. But some are at this time so small that they will escape notice, and hence the necessity for a further search in April. Ashes do not prevent egg-laying; the carbolic acid and soap mixture will. This should be rubbed on the base of the tree in July. I have but little doubt the kerosene and soap mixture, placed underground, close to the tree, would kill the larvæ, though I have not tried it. Cold will not kill the trees because of wounds made in cut-

ting out the borers, but the wounds will heal more quickly if they are well covered with grafting-wax.

"J. W. F.," before referred to, in a later issue of the same paper states that a certain peach-grower has discovered some new plan of fighting this insect, which he seems to think will prove a sovereign cure. He vaguely refers to it in the following language:

"I know a gentleman who claims he has discovered a preventive remedy, or a medicine that will absolutely prevent any injury to peach-trees from borers, and I am satisfied, from a trial of the same for the past five or six years, that he is not mistaken, and should have a patent on the same. He has followed this pest through all the various changes of its existence in his researches, and into its life and habits."

If this remedy will do what the discoverer claims for it, he should give it to the world. I am not of the opinion that a patent should be given for any insecticide. If the Government or other authorities should choose to offer a reward for some new insecticide, it would be well and proper; but then, the remedy should go to the world free, that all may avail themselves of its benefits.

THE PLUM CURCULIO—*Conotrachelus nenuphar*, Herbst.

Order, *Coleoptera*; family, *Curculionidæ*. Plate II, Fig. 3.

An examination of the plums, pears, apples, etc., early in the season revealed the fact that the greater portion of them were infested with from one to half a dozen larvæ of the Plum Curculio, as shown by the crescent symbol of the mother beetle. A little previous to this the small white egg could be seen where it had been deposited in the place hollowed out in the fruit for its reception (as shown at *d* in the figure). Though there is an apple curculio (*Anthonomus quadrigibbus*), and a quince curculio (*Conotrachelus crategi*), both together have not done so much damage this last season as the Plum Curculio.

This is one of the greatest pests of the orchard. In some places plum raising has proven almost a failure on account of

its ravages, and the crop has been almost abandoned. It would be difficult to estimate the great loss occasioned by it.

Though a very common insect, and very much written about, that all may become acquainted with it, I shall give a brief description of it in its different stages. The beetle in all its stages is shown in the illustration, magnified somewhat.

The perfect beetle varies in length from less than two-tenths of an inch to four-tenths. The general color is dark brown, with numerous spots of white, yellow and black. The wing cases have two black humps upon them, one on each side about the middle, close to the suture. Behind these humps is a band of yellow and white. The surface of the thorax is somewhat rough and uneven; the snout is longer than the thorax.

The larva is a small, footless, maggot-like worm, having a distinct head and biting jaws; length when full-grown, about four-tenths of an inch; the color is yellowish-white, or flesh-colored, varying somewhat according to the kind of fruit; there are two rows of minute black bristles along the side, the upper one less distinct than the lower one. The under part of the body brown or rust-red; the head is yellow or pale-brown.

NATURAL HISTORY.

There has been a good deal of discussion in regard to the number of broods of the insect each year, some declaring that there are two, while others just as positively declare that there is but one. However, it seems pretty well settled now, especially in latitudes north of this, that it is single brooded. I have not been able to observe in regard to the matter here.

There has also been no little discussion as to whether it passes the winter as a perfect insect or as larva. The preponderance of testimony seems to favor the former.

The beetles usually emerge from their winter-quarters early in the spring, and as soon as the fruit is formed on the tree, the female makes a crescent-shaped incision in the outer covering, which she further hollows out with her snout, into which she deposits a single pearly white egg, about three-hundredths of an

inch long and one-third as wide. Each female is supposed to deposit from fifty to one hundred eggs. Though some of the beetles thus deposit their eggs early and some appear later, and the period of ovipositing is continued for several weeks, perhaps two months.

In a short time the larvæ are hatched from these eggs, and at once begin eating their way through the fruit, tunneling in every direction. The fruit infested usually falls to the ground before the larva is full-grown and before the fruit is ripe. The cherry, however, seems to be an exception.

When the larval stage is completed the grub leaves the fruit and burrows into the ground a few inches, and changes to a pupa, coming forth as a perfect beetle in about three weeks.

NATURAL ENEMIES.

This very troublesome insect seems to have but few parasites. Dr. Fitch, many years ago, discovered a small ichneumon fly (*Sigalphus curculionis*), which is parasitic upon the larva. It is a small, black, four-winged fly, about fifteen-hundredths of an inch in length, the wings expanding thirty-hundredths. Prof. C. V. Riley also describes another parasite, called *Porizon conotracheli*, which is a small black fly, slightly larger than the above-mentioned species. Some insects are reported to feed upon them occasionally.

REMEDIES.

Owing to the fact that the beetle readily drops to the ground when disturbed, one of the best remedies is that of jarring the trees and catching them in a sheet or other arrangement prepared for the purpose. There are numerous inventions and contrivances for this purpose.

Another efficient remedy is that of gathering and destroying the fruit by feeding, or in some other way. This should be done as soon as the fruit falls, and, when possible, hogs and chickens should be allowed to run in the orchard during the season when the fruit is falling. The chickens will, perhaps, gather up many of the grubs after they leave the fruit.

But these methods will not likely destroy all the weevils, and until some better means are invented the orchardist will still lose a great deal of fruit on account of this little depredator.

Many other remedies have been tried, but most of them accomplish nothing, and we still find ourselves in a measure helpless before the little foe.

THE QUINCE CURCULIO.—*Conotrachelus crataegi*, Walsh.

Order, *Coleoptera*; family, *Curculionidae*.

This little pest often becomes very numerous in this State, causing serious damage. Last year, in some places, the quince crop was almost entirely unfit for use, being knotty and wormy. The crop seems to be in no better condition this year, so far as I have observed.

This beetle belongs to the same genus as our very destructive plum curculio; and, like it, is not confined to any one kind of fruit. It seems to have originally confined its attacks chiefly to the haw; but it is sometimes very destructive to pears.

It is somewhat larger than the plum curculio, has a longer snout and broader shoulders. In color it is somewhat ash-gray, dusky, and whitish with seven distinct longitudinal ridges on each wing case, and two rows of punctures between each. This beetle does not seem to appear so early as others.

The larva is a small whitish grub, a little more than three-tenths of an inch in length, the head is rufous, the jaws black.

Prof. C. V. Riley states that the insect spends the winter as a grub, changing to a beetle during the next summer, and hence is single brooded. This has never been denied, so far as I know. While I have not made extensive observations this season in regard to the life-history of this species, and have attempted to rear but few, I have found some exceptions to the rule. One mature beetle issued from the small number of those in my breeding jars, August 23d. It will require further observations to determine whether the species is sometimes double

brooded in this State, or whether the mature beetle hibernates. We should not jump at conclusions, nor be content with one or two observations.

One who is not well acquainted with the characters of this and some other species is likely to form wrong conclusions, from the fact that the plum curculio is more numerous in the quinces here than the quince curculio, and the former issue as beetles during the summer.

REMEDIES.

Like the plum curculio, this insect readily drops to the ground when disturbed, and may be shaken off and destroyed as recommended for that species. And since it appears later, the shaking process does not need to be carried on for so long a time.

But, as my observations show that the beetles sometimes mature in the fall of the year, they may pass the winter in this stage, and deposit their eggs early in the following season, and hence, in this climate, be double brooded.

It is nocturnal in its habits, like the plum curculio, and must be jarred from the trees very early in the morning. All fallen fruit should be destroyed, and as the larvæ usually pass the winter in the ground, many of them may be destroyed by late stirring of the soil.

It seems no parasites have been reported attacking this species. I have not been able to determine certainly in regard to the matter here; but have seen some evidences of the work of a parasite.

THE PEAR SLUG—*Selandria cerasi*, Harris.

Order, *Hymenoptera*; family, *Tenthredinidæ*. Plate IV, Figs. 1 and 2.

About June 5 I received a box of the Cherry, or Pear Slugs, from the orchard of Maj. Bryor, of Nashville. He reported great damage done in that vicinity to the pear-trees. If the leaves sent were a fair sample, the destruction was certainly great. They were almost skeletonized, and were brown and dead. The following is from a note accompanying the worms:

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"The pear-trees have been infested with these worms two years. Some trees have no green leaves on them, all eaten out. A limb projecting into the affected tree had not a worm on it, while all like the tree of which I send leaves, were all eaten up. This looks as if one species of pear is liable to the worm while others are not."

They were also reported in other orchards about Nashville.

Not only were the leaves of the tree eaten, and the trees permanently injured, but Maj. Bryor stated later that the pears were all scarred and gnarled from the same cause, either having been eaten, as he supposed, by the worms, or as a result of the defoliation of the tree. I have never heard of their eating fruit before.

This insect has been known in this country nearly a hundred years, and has often been very injurious. I have not seen any of them in this end of the State this year, though I have noticed several other species similar to this, doing considerable damage. One (*Selandria rosæ*) has almost stripped the leaves of rose-bushes in some places, and did a like injury last year. Another (*Selandria vitis*) has done considerable injury to grape-vines by eating the leaves.

These all belong to a group of insects called saw-flies. The larvæ are often called slugs from their resemblance to snails. This species is first white, but later is olive-colored and slimy like a snail. They afterward change their skins again when about ready to enter the ground, and are then a clear, bright yellow. The head is small and entirely concealed under the fore part of the body till after the last moult, or change of the skin. The number of feet is twenty. They are nearly half an inch long when full-grown. They usually feed upon the upper side of the leaves, eating only the parenchyma, or fleshy part. There are two broods each year.

However, I heard of no damage this year from the second brood. The first brood of *Selandria rosæ* were very numerous, but the second brood did no damage, so far as I observed. But *Selandria vitis* was to be found throughout the entire season, almost.

The adult is a small black fly, having four wings, somewhat smoky in appearance.

REMEDIES.

Several remedies have been used, but perhaps the best is white hellebore. It may be used dry and dusted upon the slugs. It will produce death in a very short time. It may also be mixed with water and sprayed upon the trees with a force pump, such as those recommended in the introduction. See there also directions for using this insecticide. For tall trees the liquid will be more easily applied than the powder.

If the fruit has been gathered when the second brood appears, Paris green, or other poisonous substance, may be used as well as hellebore. Prompt attention should be given to the destruction of the first brood. With a very small outlay of time and cash an orchard may be thoroughly protected. Perhaps, as suggested by Maj. Bryor, some varieties of the pear may be less liable to attack than others. This is a matter of economic importance, and careful observations should be made to test the correctness of the supposition.

THE GRAPE SLUG—*Selandria vitis*, Norton.

Order, *Hymenoptera*; family, *Tenthredinidae*.

This species of saw-fly larvæ closely resembles the one just described, the cherry or pear slug, in both appearance and habits. As previously mentioned, they were to be found nearly all summer upon grape leaves, sometimes a score or more feeding side by side. I first found them May 22d, at which time some were almost full-grown. From that time till the last of August they were to be found in all stages of development, almost all the time. I am not able to say just how many broods there were, but there were not less than three, all these overlapping each other.

Unlike the preceding species, these slugs feed upon the under side of the leaves, lying very close together with their heads outward. They also eat the entire leaf, beginning at the outer margin, and eating inward, moving backward. When very

small they cause the leaves to curl under somewhat. After about mid-summer they were found almost entirely upon the leaves near the end of the growing vine, these being more tender than the older leaves.

The body is somewhat slender, thickest near the head, tapering to the other extremity. The color is light-green, with two transverse rows of black spots. The head and tip of the body are black. After the last moult, or change of the skin, the body is almost entirely yellow. They are five-eighths of an inch in length; number of feet, twenty, sometimes appearing to be twenty-two.

They enter the ground to pupate, forming small cocoons of earth beneath the surface. The fly produced from these is about one-fourth of an inch in length, and black, except a small patch on top of the thorax, which is pale-red. The legs are light-yellow, the wings smoky.

REMEDIES.

When the worms become so numerous as to be very injurious, as they sometimes do, they may be destroyed from low vines by gathering the infested leaves and crushing them. On account of their feeding together closely upon the leaf, this may be easily done. Upon higher vines, or upon large areas, they may be destroyed, as the preceding, by dusting with powdered hellebore, or by spraying them with the liquid solution, or with other insecticides.

THE ROSE SLUG—*Selandria rosæ*, Harris.

Order, *Hymenoptera*; family, *Tenthredinidæ*.

Last summer a year ago, and again this last summer, the rose bushes about Loudon were greatly injured and their beauty marred by the Rose Slug (*Selandria rosæ*). Like the pear slug, but unlike the last described species, this insect feeds upon the upper side of the leaves, eating only the fleshy part. Sometimes almost every leaf is thus eaten, when the bush seems to have been scorched by fire, the leaves becoming a rusty-brown.

I saw these slugs upon the rose this year first about May 25. A week later they entered the ground to pupate, and in about three weeks more the flies emerged.

The slugs are green in color above, yellowish beneath, and somewhat transparent. The body is covered with minute black dots. The head is small and round. There are two broods a year. However, I saw no damage from a second brood this year.

The perfect insect is a small, black, wasp-like fly, resembling the two other species described, but a little smaller than the latter, being scarcely more than three-sixteenths of an inch in length. The wings are smoky.

REMEDIES.

On account of their habit of feeding upon the upper surface of the leaves, they are easily destroyed with hellebore or other insecticide. Hellebore seems the most deadly to all the insects of this family.

THE CODLING MOTH—(*Carpocapsa pomonella*, Linn.

Order, *Lepidoptera*; family, *Tortricidæ*. Plate II, Fig. 5.

There is scarcely a school-boy in Tennessee who has not heard of the Codling moth, though no doubt most of them have vague notions as to just what the insect appears like in all its stages of existence. There are also a good many grown up boys, owners of apple orchards, who may wish to study more fully the life-history of this widely-scattered enemy of the apple, and make further trial of remedies.

Fig. 5, Plate II, shows the insect in all its stages—larvæ, pupa, and moth; also its manner of feeding in the fruit.

Early in the season, when the apples have attained about the size of peas, the moth deposits her eggs in the upper or blossom end of the fruit; one egg to each apple. Other moths may also deposite an egg upon the same apple, hence more than one worm may be found in the fruit. This egg soon hatches, and the

small worm bores down into the apple where it spends a few weeks; but on coming to maturity it leaves the fruit in search of a place in which to pupate. When full grown the larva is about half an inch long, of a pale yellowish-white color, head brown; legs, sixteen. Preparing to enter the pupa stage, it finds some sheltered nook, in the crevice of the bark or elsewhere, and there spins its small white cocoon.

There are two broods a year. The first brood of worms soon change to pupæ, and come forth as moths, but the last brood pass the winter in their cocoons, and change to chrysalids next spring, soon after appearing as moths, which are small and dark-colored, having a coppery luster on the front wings.

REMEDIES.

Scores of remedies have been tried, but the most effectual is that of spraying the trees with Paris green or London purple, soon after the eggs have been deposited. There are some who are afraid to use the fruit from trees so sprayed, but from many tests it is found there is no danger.

Prof. A. J. Cook, of Michigan, who has experimented a great deal with this remedy, gives the following testimony:

"The danger from this practice I have proved to be nothing at all. The microscope and chemical analysis have both shown that all the poison has been removed long before we wish to eat the fruit. The wind no less than the rain helps to effect this removal, as I have shown by putting the poison on plants sheltered from all rains. Of course we should not turn stock into an orchard till a heavy rain has washed the poison from all herbage under the trees.

"I am entirely positive that a knowledge and practice of this remedy throughout our country will save hundreds of thousands of dollars to our fruit-growers. It will serve to give us fair, perfect apples known to our fathers, but which have become lamentably scarce in our modern orchards."

With such an effective remedy as this at hand it is scarcely necessary to give others, which require more time and cost

more. For large orchards the cost of spraying twice need not be more than about 3 cents per tree.

Half a pound of London purple, or three-fourths of a pound of Paris green, may be used to a barrel of water, or about a teaspoonful to a pail of water.

THE CANKER-WORM.

Order, *Lepidoptera*; family, *Geometridæ*. Plate II, Fig. 1.

In all the literature of economic entomology, perhaps no insect has had more frequent mention than the Canker-worm. Not only so—expressions like this were indulged in more than twenty-five years ago, and I feel almost like offering an apology for taking space to treat of an insect whose name has become a household word. However, we sometimes become so accustomed to the sound of a word that we never think of its meaning; and I doubt not a dozen different readers of these lines will each have in his mind a different insect, making a dozen different so-called canker-worms; while after all, the subject will be new to many of the readers, and a great many more have no practical knowledge of the insect's habits; while a still smaller number are able to recognize the larva and both sexes of the adult insect at sight. During the summer I saw an article in a certain agricultural paper in which was mentioned the great injury canker worms do by *boring into apple-trees!*

Early in the spring the minute eggs placed upon the trees by the mother moth are hatched, producing a small, almost hair-like span-worm, or measuring-worm, altogether very delicate and harmless in appearance. The general color is light-brown or olive-green, with a shiny black head, having a white dorsal line, also a white stripe on each side of the body. There is considerable variety in coloring in the full grown larva, ranging from light-gray to almost black. They attain their full growth in three or four weeks after hatching from the egg, at which time they are almost an inch in length. The worms then descend to the ground by means of a silken thread, or down the trunk of the tree, and burrowing two or three inches undergo

their transformations in a rude cocoon, changing in about two days to a light-brown chrysalis.

There seems to be but one brood each year; at least this is true in the more northern States. Though moths occasionally issue in the fall months, the greater number do not come out till the early spring, when the females ascend the tree to lay their eggs, which hatch just in time for the young worms to feed upon the first opening apple leaves.

The two sexes of the moths differ greatly in appearance. The female is entirely destitute of wings, and the body is much larger than that of the male. The fore wings of the male are pale, ashy-gray, with no very conspicuous markings. The hind wings are silvery-gray. The wings are very thin and delicate.

REMEDIES.

Since the female is wingless, the most effectual device is that which will keep her from ascending the tree to deposit her eggs. One method of preventing their ascending the tree is to put a band of cloth or canvas six inches wide around the tree, and smear with a mixture of tar and molasses; or place a rope band around the tree, over which put a strip of tin four inches wide; fasten closely to the tree below, and flaring out from the tree two inches at the top. There are numerous other devices prepared for this purpose. One of these, made of a tin band encircling the tree, and a muslin supporter, is called the canker-worm trap.

If the moths are thus prevented from ascending the tree, they will deposit their eggs below, when they can be destroyed by an application of kerosene.

When trees have been unprotected and the moths have already ascended, the eggs may be found on the under side of the scales of bark on the trunk, or on the branches, in which case many of the eggs may be destroyed by scraping off and burning the scales. But they may also be found upon the smooth bark of the twigs.

If the eggs are allowed to remain on the tree and hatch, when the worms are large enough to be seen, by jarring the

trees they will drop down by a thread, when they may be knocked down with a stick and destroyed, or they may be destroyed by spraying with London purple. Prof. J. A. Lintner quotes the following in his Second New York Report from some extensive fruit-growers of Oakland, N. Y.:

“From 1873 to 1878 the Canker-worms made sad havoc in our large apple orchard of a thousand trees. After spending several hundreds of dollars in trying to destroy them, we sprayed them with London purple, and have never had to do it since.”

With a remedy so simple and easy as this, nothing but negligence need ever cause the orchardist from losing any large amount from these worms. The application of the insecticide should be made early in the season.

In an orchard which has been badly infested, during summer or fall turn in hogs and induce them to root about the trees by dropping grains of corn into holes made into the ground. By this means they will destroy many of the chrysalids. They may also be destroyed by fall plowing, since this breaks up the cells they have formed in the earth, and they will be killed by freezing.

Several species of birds sometimes feed upon the worms in the orchard, and greatly reduce their number.

BENEFICIAL INSECTS.

LADY-BIRDS, or LADY-BUGS.

Order, *Coleoptera*; family, *Coccinellidæ*. Plate IV, Fig. 5.

There is a large number of species of insects commonly called Lady-birds, or Lady-bugs, which deserve especial mention on account of their valuable service in destroying certain other insects called Plant lice (*Aphides*), small, green, lice-like insects, which live by sucking the juices from plants. They are found upon almost every form of vegetation, from the tiniest blade of grass to the largest tree of the forest. Not unfrequently the Lady-birds are suspected of doing some injury themselves, since they are often found in great numbers about the infested plants; and often they are destroyed by those ignorant of their true character. They very rarely eat vegetable food, but live almost exclusively upon animal food, and ought to be protected.

These insects are easily recognized by any one who takes the trouble to notice them. The body is rounded on top, flat below, being almost hemispherical in form. The ground color is usually red or yellow, covered with black spots. Their size is small, seldom exceeding a third of an inch in length.

The larvæ, which are variously colored—some species having three or four different bright colors—have a slight resemblance to the larva of the Colorado potato beetle. During this stage they live exclusively upon insect food, seeming to prefer, as do the adults, to feed upon the tender and juicy plant lice.

Plate IV, Fig. 5, represents the convergent Lady-bird (*Hippodamia convergens*, Guer), showing the larva, pupa and imago. This species has been one of the most plentiful here this season. I have seen the larvæ eating the cabbage-plant louse (*Aphis brassicæ*) and other species, often.

The beetle is about one-fourth of an inch long; the head has a black band across the posterior part; thorax black, with yellow margin, and two yellow stripes diverging in front; the wing cases are orange-yellow, with six black dots on each.

The larva has blue, black and orange colors distributed over the body. The pupa is usually attached to a stick or board by the hinder part of the body.

THE SPRING CANKER-WORM—*Anisopteryx vernata*, Peck.

Order, *Lepidoptera*; family, *Geometridæ*. Plate II, Fig. 1.

There has been no other insect, perhaps, so much written about and talked about during a long period of time, as the Canker-worm. And yet it has been thoroughly studied only in recent years. Scientists even confounded two closely allied species, considering them the same. These two species are the Spring Canker-worm (*Anisopteryx vernata*, Peck), and the Fall Canker-worm (*Anisopteryx pometaria*, Harris). The illustration of this insect appearing on Plate II., Fig. 1, is *A. pometaria*, though originally prepared to illustrate *vernata*. Since the two insects closely resemble each other in almost all stages, and I have no true illustration of *vernata*, this will suffice, as I shall not discuss the structural differences of the two species.

I have seen only the Spring Canker-worm here, and this alone will be treated at this time.

Not only have scientist confused these two species, but farmers, and some who presume to write for the agricultural press, have confounded it with other very distinct species, belonging even to different orders. During last season an article appeared in a certain agricultural paper, portraying in strong language the great injury Canker-worms cause, *by boring into apple trees!* Everyone who knows anything about the insect must know that it feeds upon the leaves only. The author no doubt wished to speak of the damage done by either the flat-headed apple-tree borer (*Chrysobothris femorata*), or the round-headed borer (*Saperda candida*), two insects very different from the one un-

der consideration, as they both belong to the order *Coleoptera*, or Beetles, while the Canker-worm belongs to the order *Lepidoptera*, Butterflies and moths.

By way of digression it may be said here, that this carelessness or ignorance on the part of writers, and the general lack of information among farmers, concerning our most common insects, greatly impedes the progress of insect extermination. Farmers ought to be better informed. If they have not time to make observations for themselves, they ought at least to read much on the subject.

I give briefly the natural history of the insect, together with a few practical remedies.

Early in the spring the minute eggs placed upon the trees by the mother moth are hatched, producing a small, almost hair-like span-worm, or measuring worm, altogether very delicate and harmless in appearance. The general color is light-brown or olive-green, with a shiny black head, having a white dorsal line, also a white stripe on each side of the body. There is a considerable variety in coloring in the full grown larvæ, ranging from light-gray to almost black. They attain their full growth in three or four weeks after hatching from the egg, at which time they are almost an inch in length. The worms then descend to the ground by means of a silken thread, or down the trunk of the tree, and, burrowing two or three inches, undergo their transformations in a rude cocoon, changing in about two days to a light brown-chrysalis.

There seems to be but one brood each year; at least this is true in the more northern States. Though moths occasionally issue in the fall months, the greater number do not come out till early spring, when the females ascend the trees to lay their eggs, which hatch just in time for the young worms to feed upon the first opening apple leaves.

The two sexes of the moths differ greatly in appearance. The female is entirely destitute of wings, and the body is much larger than that of the male. The fore wings of the male are pale, ashy-gray, with no very conspicuous markings. The hind wings are silvery-gray. The wings are very thin and delicate.

REMEDIES.

One of the most generally recommended remedies is that of preventing the wingless female from ascending the tree to deposit her eggs. This is done by placing a band of cloth or canvas about the tree two or three feet from the ground. This must be thoroughly smeared with a mixture of tar and molasses or other substance. A similar method is to place a rope band about the tree, over which place a piece of tin four inches wide, which must be attached closely to the tree below, flaring out at the top; or it may be arranged to stand out below the band, being fastened above. There are also other devices used for the same purpose. If the moths are thus prevented from ascending the tree, they will deposit their eggs below the band, and may be destroyed by an application of kerosene.

That this remedy may be effectual it must be prepared very early in the spring, as the moths will come out the first warm days.

If the moths are not prevented from ascending the tree, and the young canker-worms appear in destructive numbers, when they are large enough to be seen readily, by jarring the trees they will drop down by a thread, and may be destroyed while suspended.

They may also be destroyed by spraying with Paris green. There will be no danger of poisoning the fruit if sprayed before the apples have attained the size of hazel-nuts. This has been proven by many experiments made by the best scientists of the country. The poison will all be washed away before the fruit ripens. Many other insects will be destroyed at the same time, also.

In an orchard which has been badly infested during summer or fall, turn in hogs and induce them to root about the trees by dropping grains of corn into holes made into the ground. By this means they will destroy many of the chrysalids. They may also be destroyed by fall plowing, since this breaks up the cells they have formed in the earth, and they will be killed by freezing.

Several species of birds sometimes feed upon the worms in the orchard, and greatly reduce their number.

A number of other insects also join in the warfare, some eating them, others as internal parasites. But there are generally enough left in a badly-infested orchard to make sad havoc among apple, plum and other trees.

THE FALL WEB-WORM—*Hyphantria textor*, Harris.

Order, *Lepidoptera*; family, *Bombycidae*. . Plate II, Fig. 6.

The webs or tents of this insect were to be seen almost everywhere this season, and upon almost all kinds of trees. They appeared at Loudon first about the middle of May, or a little later. I saw them first upon pear-trees and osage-orange. About June 1st I noticed almost all the shade or fruit trees in Chattanooga were badly infested with them. The second brood appeared about the first of August, and seemed more abundant than the first. In Greeneville some large shade trees had not less than twenty webs or bunches of the worms. They are often numerous upon the persimmon.

The larvæ are of a greenish-yellow color, usually varying somewhat, and have a broad, blackish stripe along the back, with a bright-yellow one on each side, while the body is covered with numerous black dots, and from the small tubercles arise bunches of hairs which cover the body. During most of their lives they live under a web, like the Tent Caterpillar (*Clisiocampa*). After the last moult, however, they abandon the web and crawl freely about. They are then about an inch in length. The caterpillars began to enter the ground to pupate about June 20th. The first moths came out in my breeding jars about July 10th, others coming out several days later.

The chrysalis or pupa is mahogany-brown, about four-fifths of an inch in length. It is enlarged in the middle, as shown in the illustration (Plate II, Fig. 6), and tapers posteriorly to a point.

The moth is pure white, without spots or conspicuous markings of any kind. Its wings expand about 1.8 inches.

REMEDIES.

Since they feed closely together under a web most of their lives, they are easily destroyed by burning the web, or by tearing it down and crushing the worms upon the ground. They may also be killed by spraying with the various insecticides. Their webs make them conspicuous, and since they are readily destroyed, when found in great numbers in orchard or shade trees, they stand as monuments to the owner's carelessness.

THE BUFFALO GNAT.

Numerous paragraphs appeared during early summer in both agricultural papers and newspapers of the State in regard to this dreaded pest, which was to be found chiefly in the western part of the State.

At that time I had no opportunity of visiting that region to make a personal study of its life-history, habits, etc. However I made mention of the insect two or three times in the columns of the *Spirit of the Farm*, asking for information concerning the ravages of the insect, what remedies were used, etc., and requested specimens. I also wrote private letters to the same effect; and notwithstanding return postage was inclosed, I failed to get a single reply, except the indirect one which I give below on account of a few items of information it contains. It was published in the "*Spirit*" sometime in June, and is as follows:

"So destructive have been the ravages of insects this season, that every farmer should be alive to the importance of devising means for their destruction, or staying their expensive ravages. I trust the investigations of Professor Doran, in this line, will enable him to impart much valuable information to your readers upon this subject. I trust, however, the Professor will pardon me if I enter an earnest protest against his request that specimens of the Buffalo gnat be sent him for examination and study.

"If the interest of science demands this investigation, we shall favor a special appropriation to enable the Professor to

trap for the little hunchbacked demon in his native jungles along the Mississippi, White and other western streams, where he is more destructive than the tiger in the jungles of India. Why, sir, I saw it stated that he had actually attacked and killed at least one negro in Crittenden County, Arkansas, this season. Just think of it. Having once tasted human gore, may we not expect, in future, to hear of man-eating Buffalo gnats? No sir, give us a rest on insect importation. Unless it can be shown that the b. g. will prey on Colorado beetles or English sparrows, don't transplant him. In the name of all the mules this side of the Cumberland Mountains, we protest against importation of live gnats.

"But, if come he must, let him be brought in chains and be strictly guarded behind bolts and bars. He is a blood-thirsty monster, and more reckless of his own life than Herr Most, the bloody anarchist.

"Perhaps my alarm is premature, and cadavers will answer the Professor's purpose. Even then we would insist that after dissection the remains be thoroughly cremated to prevent the possibility of propagation."

Finally, through the kindness of a friend in another State, I received specimens of the insect in all its stages. As they have been securely bottled in alcohol now for many months, I think that by the time I get through with them neither they nor their ghosts will ever get back to trouble the "mules beyond the Cumberland," the presentiments of "J. W. R.," the writer of the above, to the contrary notwithstanding.

In some of the countries of Europe there is a gnat (*Simulia columbaschensis*) resembling this, and also a similar one in South America, which causes great loss of life among stock, especially horses and cattle; and even children are sometimes killed by them. Though a small gnat or fly, not more than one-fifteenth of an inch long, yet sometimes such swarms of them congregate together that they resemble a small cloud of smoke. Stock of all kinds will flee from them to some place of shelter. They always select some tender and unprotected part, as the corners of the eye, the nose, the mouth, and sometimes enter the nose or ear. The bite of the gnat causes a burning, itching, swell-

ing; many together causing an inflammatory fever, or even convulsions. Death often results to stock in a few hours; sometimes a lingering disease is the consequence.

This fly passes its earlier stages in the water, as does our common mosquito; and they are usually more abundant in warm, marshy countries. However, they are found in cold and mountainous countries, this, or a similar one, being known in Lapland.

They appear early in summer, and sometimes in such immense numbers that one can scarcely breathe without taking them into the nose or mouth.

The gnat which has given us so much trouble in this State is probably an undescribed species. Prof. F. M. Webster, of Lafayette, Indiana, spent two or three months last spring along the Lower Mississippi, under the direction of Dr. C. V. Riley, United States Entomologist, studying the life-history and habits of this insect. His researches have not yet been published. The results of his studies will be awaited with interest.

The larvæ are found in running water. They are small, whitish grubs or maggots, about a quarter of an inch in length when full grown. They taper from the anterior end to near the middle of the body, when they slightly enlarge, ending with a swimming appendage. The pupæ are about two-thirds the length of the larvæ, thicker, darker in color, with two or three tufts or bunches of hair. The perfect insect is scarcely more than an eighth of an inch long, wings large, color of body dark-brown.

I give only this brief description, awaiting a fuller description and determination of the species by Professor Webster.

The length of time that the gnats continue their depredations seems to be not more than four weeks. A correspondent from Shelby County, in the May Crop Report, makes this statement: "Buffalo gnats came April 19 and left May 15; they were terrible." A correspondent from Lauderdale County states in the April Crop Report that gnats had not yet appeared. This was probably written, according to instructions from the Commissioner, not later than April 20.

As intimated in the quotation from "J. W. R.," the State could well afford to make an appropriation to have this insect thoroughly studied in that part of the State where it appears. Such an appropriation will seem more especially needed, however, when it is remembered that there are about five hundred other injurious species of insects in this State needing such special work.

REMEDIES.

I have but little information as to what remedies have been most successfully used, but I have no doubt that a careful study of the habits of the insect, together with rational experiments, would discover remedies which would effectually protect the stock.

In European countries where the previously mentioned pests are very numerous, the inhabitants make use of smoke to drive them away. Large heaps of straw, hay and rubbish are collected together near their houses or pastures. These heaps of rubbish burn slowly and make a great deal of smoke, which drives away the gnats, just as we sometimes drive mosquitoes from our houses. Stock will gather together about these heaps, and thus be protected. But this can be but an imperfect remedy, since it cannot protect stock during all the feeding time. Cattle are sometimes washed with a decoction of wormwood; but this is not very effectual, unless often used. A salve is made from tobacco leaves, about one pound of leaves to a gallon of water; this is boiled down about one-half, then poured off, and the boiling continued till it forms a syrup of the consistency of honey. To this add a pound of lard and half an ounce of petroleum oil. These are thoroughly mixed, and the stock smeared with it every third day about the parts most liable to attack. This seems to be a certain protection.

In case much injury had been caused by the bite of the fly, warm poultices of linseed oil and water, fresh butter, etc., which will allay the burning, are applied at once to the parts affected, followed by warm baths, while cooling drinks are taken internally.

LADY-BIRDS.

Order, *Coleoptera*; family, *Coccinellidae*. Plate IV, Fig. 5.

The insects of this family, commonly called Lady-birds, or Lady-bugs, are nearly all beneficial, hence are mentioned here for the good they do. In both the larva and adult state they feed almost exclusively on Plant-lice (*Aphides*), those small, usually green insects found sucking the juices from plants. Almost every plant has one or more species of these lice, which feed upon it; and sometimes they are so numerous as to almost cover the plant, hence they either check its growth greatly or kill it outright. Every farmer has seen these small beetles crawling about over various plants and trees, and not unfrequently they are suspicioned of mischief of which they are entirely innocent. And these lines are written that the farmer may recognize these insects as his benefactors, and treat them as such.

The adult beetles are rounded and hemispherical in form; the antennæ are enlarged at the tips; their color is usually of a yellow or reddish ground with black spots, or black ground with yellow or red spots. The size is small, few species reaching a third of an inch in length. The larva are somewhat fleshy, variously colored, and attaining usually about half an inch in length. They move about over plants searching very carefully for their food.

The illustration on Plate IV, Fig. 5, represents the larva, pupa and imago of the convergent Lady-bird (*Hippodamia convergens*, Guer), which I have found very plentiful this season. The beetle is about one-fourth of an inch in length; the wing cases are yellow, with six black dots upon each, one on the shoulder smaller than the rest, and sometimes wanting. The larva is conspicuously marked with blue, black and orange. The pupa, which seems somewhat smaller than the adult, is attached to twigs, blades of grass, fences, etc.

APPENDIX A.

LIFE AND HABITS OF INSECTS.

A Paper read before the East Tennessee Farmers' Convention, May 19, 1886.]

I can, perhaps, present no fitter introduction to this subject on this occasion than to give a brief history of Economic Entomology in this country.

It is one of the new sciences which practical, earnest, but withal, learned men have wrought out in the name of advanced thought in agriculture. This study, directed by scientists, has been materially aided and practically encouraged by the careful observations of intelligent farmers.

About forty-five years ago, Dr. T. W. Harris issued the pioneer work on Economic Entomology, a "Report on the Insects of Massachusetts, Injurious to Vegetation." Several editions of the work have been published, and it now finds a place in almost every Entomological library in this country and in Europe.

About fifteen years later, Dr. Asa Fitch began to publish his annual reports of the injurious and other insects of New York. Fourteen reports were issued by him as State Entomologist, forming a very complete and valuable library.

Later, valuable additions to the literature and practical knowledge of the subject were made by Prof. C. V. Riley, State Entomologist of Missouri for nine years, and by Mr. B. D. Walsh, Dr. Wm. LeBaron and Dr. Cyrus Thomas, successively State Entomologists of Illinois. Dr. A. S. Packard, Jr., of Massachusetts, has issued many valuable works on injurious insects, including three reports as State Entomologist. Prof. J. H. Comstock and Mr. Townsend Glover, as Entomologists, suc-

cessively, to the United States Department of Agriculture, have rendered valuable service and have added largely to the literature of the subject.

Among those who are now actively engaged in the work, doing valiant service, and through whose influence thousands of dollars are annually saved to the farmer, may be mentioned the following: Prof. C. V. Riley, Entomologist to the United States Department of Agriculture, with a large corps of assistants in various parts of the country; Prof. A. J. Liutner, State Entomologist of New York; Prof. S. A. Forbes, State Entomologist of Illinois; Prof. A. J. Cook, of Michigan Agricultural College; Prof. Herbert Osborne, of Iowa Agricultural College; Prof. F. H. Snow, of Kansas Agricultural College; Prof. G. H. French, of Southern Illinois Normal College; Mr. Matthew Cooke and Dr. Chapin, of California, and many others.

But we must not forget the position recently taken by our own State. Our enterprising Commissioner of Agriculture has determined that the wealthy and powerful States, north, east and west of us, shall not much longer surpass our zeal in utilizing the discoveries of science. It remains for the people, the farmers, to say how successful we shall be.

One evidence of progress in this department is found in the fact that the people are becoming more interested. They begin to see it is a paying investment.

A well-known gentleman of New York gives it as his opinion that the reports of Dr. Fitch, former State Entomologist, have saved the farmers of that State annually \$50,000. If two or three thousand annually invested save fifty thousand, practical business men can at once see that it pays. What can be done in New York can be done in Tennessee. Let those who are interested, who are the sufferers, see that the work is carried on.

Be it remembered, however, that though an Entomologist may give his time to the work, discover valuable remedies and means of defense, and note in detail the life-histories of our most injurious species, after all, little will be accomplished if the farmer does not acquaint himself with the subject. He

- must learn to distinguish his friends from his foes, and recognize them in their various stages of development, and learn when and where they are most vulnerable; otherwise he may destroy his best allies.

Failing to recognize the insect in all its stages, he may waste his energies in destroying a species quite different from what he thinks, or spend much valuable time and lose many valuable products by failing to apply the remedies at the proper time. He cannot be too well acquainted, even with our most common insects. For this reason no doubt, the subject of life-histories of insects has been assigned on this occasion.

In our country and in our own State we have made great advancement in studying Economic Entomology within a short period, but much remains to be done.

There should be a united effort on the part of those interested. If a single farmer should determine to rid his premises of noxious insects, in many cases he would find it almost impossible, from the fact that while he is exterminating his own pests the neglected field of his neighbor across the road will continually replenish his waning forces. Now, if a neighbor's hogs, or cattle, or horses continually break in and destroy the fruits of your industry, you will not submit to it, and the law will protect you. But has a man any more right to stock your farm with destructive insect hordes which will destroy your crops as certainly as his hogs or cattle? And has he the right to kill the birds, your natural protectors, any more than he has to tear down your fences which protect you from the hungry herds without?

The farmer ought to be protected by law from the injury of his careless neighbors who continually restock the community with noxious insects.

Some of our States have passed protective laws, and, so to speak, have quarantined against certain pests, and even some of the islands of the ocean have done more in that respect than our own fair State. Our legislators pass enactments in regard to almost every other interest, public and private, large sums of money are appropriated for other industries, why not for this?

The farmer is one of the most important factors in our national existence, and his is the hand which holds the bread that shall feed the hungry millions. All other occupations and avocations in the universe depend largely upon him for strength and sustenance, just as the plant derives its nourishment through the roots from the ground. Are there not farmers enough, and others interested in our Legislature to see that their industries are fostered?

The judicious expenditure of two or three thousand dollars annually by the State in subduing our insect foes will repay the principal and interest, and all classes will be benefited; for bread and meat will be cheaper, because the farmer has more to sell.

If the farmer was thoroughly acquainted with the real extent of his loss he would demand more. The "fly" may destroy one-tenth of his wheat, as it often does, and the cut-worms destroy one hill in ten of his corn, or more, or take a tithe of his pasture or his vegetables; the cabbage insects destroy one-tenth or half of his cabbage, the potato beetle destroy one-tenth of his potatoes, various circurios and worms take one-tenth of his apples, pears, peaches, plums, grapes and cherries, while like inroads are made upon his tobacco and other crops. And then his shade trees are half stripped of their leaves, and the trees themselves bored through and through.

These are not mere fancies, creatures of the imagination; if any man doubts it, proof can be furnished. Instead of a tenth, I have seen large areas of valuable land cleared from the ground as if swept by a fire.

These things did not all occur in some other States; nine-tenths of some of our own crops were destroyed last year in certain districts in this State. And yet, all is endured very complacently and but little effort made to remedy it.

But suppose some night your neighbor's hogs should break into your garden and root up a large part of your potatoes, and the next night his cattle break in and ruin a young orchard and run through your garden, and the next night his horses and mules break in and bite off and trample out ten or fifteen acres

of corn, and the next night his boys carry off a lot of your finest apples, eat your strawberries, etc.

Do you think you would not test the force of our laws or have recourse to a shotgun? And if one had no laws to protect a man's crop from his neighbor's stock, think you not that you would petition the next Legislature to pass such laws? But is it worse that a man's hogs destroy your crops than his insects? It matters not whether swine or "bugs" do the damage, the loss is the same, and a remedy ought to be provided for each. It will be if you demand it.

Having given a few general items of interest, let us come now more directly to the subject assigned—the lives and habits of some of our most common injurious insects. I shall not enter into a dry, scientific discussion of the subject, since, no doubt, you do not care to hear it just now.

Perhaps none are more entitled to the place of honor (?) than

CUT-WORMS.

Some one inquired very earnestly on this floor at the meeting of this Convention last year, "What shall we do with the cut-worm?" I doubt not a good many farmers have asked the same question this year.

A few weeks ago I received a box of cut-worms from Dr. W. M. Clark, editor of the enterprising *Spirit of the Farm*, at Nashville, accompanied by a letter, from which I take the privilege of quoting the following, in regard to their ravages:

"They have appeared in this vicinity in countless numbers, destroying grass, vegetables, meadows—everything but wheat. They destroy oats and corn, but wheat they do not touch. I got these from a wheat field. They were feasting on timothy sowed in the field, but I failed to find any injury to the wheat. In an adjoining wheat field there was no timothy, and yet no wheat was cut down. These varmints remain on top of the ground in the wheat field, crawling around active enough, but in the garden they have taken refuge in the earth, under clods, etc."

The next week, May 28, the editor gave the following account of his visit to the infested region:

"Last week we visited some farms on White's Creek to see the depredations of the worms. About three weeks ago they made their first appearance on these farms, about four miles out. We visited the place of Esquire Peter Tumble, and on entering the garden saw at once what they had done. This ground was swept as clean as if a prairie fire had swept over it. Everything had been cleaned off except the peas, and they had just begun on them. Raising a small clod of earth, there would be seen hundreds of worms piled promiscuously under it. They seemed to agree pretty well, as they were lying peaceably and quietly together. A cabbage patch had but one row, and that row was wrapped with paper. They did not trouble them, though they were around it in crowds awaiting the softening of the paper, so they could cut it.

"We visited a large wheat field next, and on all sides we saw thousands of the crawling creatures. They did not interfere with the wheat, but appeared to be living on young timothy grass sowed last fall. They were everywhere over the ground and under all loose clods. Last year the same worms infested the crops on the opposite side of the Cumberland River, while on that side there were none. They did not interfere with the wheat then, nor do we think they will now. They were unquestionably cut-worms, and were of all sizes, from little, thread-like, to the large, fat, full-grown worms.

"Esquire Tumble had purchased large numbers of chickens, and fixed coops in various parts of the wheat fields. The spots we examined where the chickens had roamed a day or two were pretty well cleaned up from the worms, and we think they will eventually destroy them all. A gentleman in our office says he destroyed them effectually one year by means of shoats. He turned them on a field where myriads of the worms were eating the field, and in a couple of days a worm could not be found.

"They have, in the White's Creek section, destroyed nearly all the oats, clover, grass, gardens, pastures and meadows; also all the corn is cut down. A peculiarity of the vegetation cut down by worms is it does not often grow up again. The bite

seems to poison the plant so it dies outright. We saw a gentleman the other day, living about three miles from the point visited, and he informs us that they are worse now than when we saw them. This is natural, for they have grown larger and stronger."

The same paper, under date of May 12, gives the following from one of its correspondents:

"It seems humiliating that a human being should be compelled to submit to the power of a cut-worm, and yet we have had to yield to smaller foes than that, at least for a time. If, after so cold a winter as that just passed, the ground is all alive with these pests, what will they do in the course of time? .

"I am using one remedy most successfully now, and that is pyrethrum powder. One tablespoonful to a bucketful of water, sprinkled on every plant, or the powder itself, about as much as will lie on the point of a good-sized pen-knife, applied to the plant where it touches the ground. .

"I hope some of your observant readers may improve on this, and give us the benefit through the *Spirit of the Farm*."

Under the same date another correspondent makes the following extraordinary statements:

"Knowing my field to be full of cut-worms, I wondered why a strip of new oats was not touched, and looking under a mullein plant one day I picked a few; I then got a cup and counted 266, two days after 34 more, five days after 158, and this morning 52, making 512 worms from under a single plant; nor am I yet done with the plant, for I have taken the leaves, dipped them in a solution of Paris green and scattered them over my garden, and shall carefully note results."

The following paragraph is from a Maury County correspondent of the same paper, published May 5:

"The cut-worms have done what the oldest farmers declare they never saw before, namely, eaten up fifty or sixty acres of grass for me and my neighbors. They passed through one piece of weedy pasture, however, and kindly ate the weeds and left the grass, so I am told."

I have observed them very destructive in my own garden. One species did considerable damage to onions, cutting off the tops near the surface of the ground. Another species destroyed radishes and beets, and another, cabbage, beans, etc. Great damage to corn is reported in Loudon County.

But I need not say more to convince all that cut-worms are destroying thousands of dollars worth of our crops this year. I believe the farmers present on this occasion will say I am not putting this too strong. But what are we going to do about it? Let them go on and multiply for a few more seasons, until they march through this land like the dreaded army-worm?

I must not detain you longer, except with a few more practical

REMEDIES.

When they come in such numbers as they have this year, turn in all the chickens and pigs available. Though ordinarily they remain under the surface of the ground during the day, out of reach of chickens; the pigs will soon find them, and destroy great numbers.

If these remedies cannot be resorted to, the worms may be entrapped and poisoned by means of small bunches or balls of clover, sprinkled with Paris green water placed plentifully in the infested crop, just before dark. After night the victims will come forth, eat of the clover and die. If the poison is not at hand, or you do not wish to use it, examine the clover bunches each morning and destroy the worms collected under them. Cabbage leaves and other substances may be used in the same way.

A man can make good wages digging them out of the ground and destroying them. When they are plentiful, thousands may be destroyed in a day by one hand.

There are numerous other remedies that may be used with good effect on small areas; among them may be mentioned sprinkling with salt, and punching holes into the ground with a smooth sharp stick, if the ground be compact, into which the worms will fall, and be unable to crawl out, hence may be destroyed by thrusting the same stick into the holes again.

When they crawl about over the ground in the day time, as mentioned by Dr. Clark, a good roller might be used for crushing them by wholesale.

Another insect which seems clamoring for recognition about now is

THE COLORADO POTATO BEETLE.*

Just at this time the potato-growers are wondering whether they or the "bugs" will get the larger share, but in some cases I think there is not much doubt about it, since, judging from appearances, the chances are largely in favor of the latter.

Passing a potato patch a few days ago I saw the owner out in the cool of the evening sweeping the beetles off his half-eaten vines with a broom. I informed him that he could do more good with a dime's worth of Paris green, in fifteen minutes, than with his broom in a whole day. He was less than a hundred yards from a drug store, where the article was kept.

I gathered from my own crop of potatoes hundreds of eggs and beetles when they first made their appearance, and thus kept the pests at bay for a while in this way alone, and since have destroyed them with Paris green. They seem to be everywhere, and the tuber is likely to have a hard year of it. A correspondent states (in the *Spirit of the Farm*, May 5th) that the Colorado Potato beetle is playing sad havoc with the potato crop of Williamson County. They are full-grown, and seem to be eagerly watching at every hill for the appearance of the plant. These they devour as soon as they are above ground, so there is no way to administer Paris green or other insecticide.

The best remedy, as intimated above, is that of hand-picking when they first make their appearance. They may be shaken into a vessel containing water, with a little kerosene added, which will remain on top; or gathered and afterward destroyed by scalding, or otherwise. Also gather all the eggs, which are laid in clusters on the underside of the leaves, and destroy them.

* For an illustration of this insect, *Doryphora ten-lineata*, see Plate I, Fig. 3.

But after they have come too fast to rid the vines in this way, or the eggs left in the patch have hatched, the best remedy to be applied is Paris green. One or two tablespoonfuls to a bucket of water, well sprayed or sprinkled upon the plants, is certain death to the beetles. Or one-half pound may be used to forty gallons of water. The insects may not die for a day or two after the poison is applied, but it is none the less sure on that account.

It may also be used dry, mixed with some other substance, as ashes, lime or flour. Flour is the best, and for potatoes one part of the poison should be used with twelve parts of the flour, and sifted upon the plants when the dew is on, or after a rain, as it will take effect better when the plants are wet. If these remedies are properly attended to, no one need lose his potato crop.

There are numerous machines for applying the poison, especially as a liquid, by spraying; and for large areas, one should be used.

Remember that Paris green is a poison, and should not be handled with the hands. Care should also be taken in dusting that the wind blow the powder from you, to prevent inhaling it.

It is sometimes feared potatoes will be rendered unwholesome by its use. There is no need for any concern in this respect. I speak from personal experience.

CABBAGE INSECTS.

There is scarcely any other plant which has so many destructive insects as our common cabbage. I shall give a brief mention of a few of them.

THE HARLEQUIN CABBAGE-BUG.

Murgantia histrionica, Hahn.

This was one of the first to begin operations this spring, and one of the last to go into winter quarters last fall, remaining till late in December. They were to be found ready for the campaign this season as early as April 9, and a week later they

were to be found in great numbers, sunning themselves on mustard stalks, waiting for the cabbage to grow. Within less than twenty-four hours I collected two hundred from a patch of mustard not exceeding one square yard in area. This pest is so common that most growers of vegetables will need no description of it.

The amateur or the uninitiated will be able to recognize it from the following characteristics: It is about three-eighths of an inch long and one-fourth of an inch wide. It is marked with blue, black, red, orange and white. With a little variation in its tintings, or by winging our imaginations, we could see the pride of our nation—the red, white and blue—floating from every turnip top and cabbage head in all the land.

The eggs, which are laid on the under side of the leaf, in clusters of about a dozen each, regularly arranged in two or three rows, cemented together, resemble so many miniature beer kegs. They have a black band about each end, while the “head” is marked with a black crescent. In a short time the “head” is “knocked out,” and there issues a thing of life, small and delicate, which soon becomes arrayed in colors, like those of the parental tunic; and perhaps within a month has become the progenitor of another race. And thus the breeds succeed each other in quick succession the summer through.

Instead of eating the cabbage, they only suck out the juice through their horny beaks, usually concealed under the body. A badly infested plant soon wilts, as scorched by fire.

Though this pest is found in almost all parts of the country, it is peculiarly a Southern insect; a native of Texas, it is claimed.

While cabbage is its choice of food, when that is wanting, other cruciferous plants, such as mustard, turnips, etc., are eaten, and it is reported they sometimes attack corn and grapes.

REMEDIES.

No parasites are known to destroy them, and our feathered friends never molest them. This is one of those almost invulnerable pests which most of our insecticides fail to affect. Prof. J. A. Lintner, State Entomologist of New York, took specimens

of this insect, in all stages of development, and rolled them in pyrethrum, Paris green, hellebore and London purple, all of which apparently had no effect upon them.

Undoubtedly the best remedy is that of gathering and destroying the bugs when they first make their appearance in spring, then keep it up all summer. They drop to the ground readily when disturbed, and by taking a vessel containing water, with a little kerosene to float on top, they may be knocked into it and destroyed very easily. An hour's work will thus destroy hundreds of the pests when they are plentiful. I have seen them so thick that a hundred could be gathered in five minutes. The eggs should also be gathered, and in this way the cabbage can be effectually protected. The young bugs can no doubt be destroyed very easily by sprinkling with hot water, of as high a temperature as the plants will endure.

The Cabbage Plant Louse (*Aphis brassicæ*) is another insect which made its appearance very early this season, and worked late last season, and did a great deal of damage. I shall notice it briefly. All farmers and gardeners, perhaps, have noticed small green lice, some with wings, some without, upon the cabbage and many other plants. They belong to the same order to which the last-named species belong, the *Hemiptera*, or bugs; and live by sucking the juice from the plants. There are a great many species; the one under consideration lives upon the cabbage, and is found in such great numbers as sometimes to almost cover the leaves.

REMEDIES.

I have noticed three parasites destroying them this year, and doing good service. Drenching with soapsuds will destroy the young ones. Sprinkling with tobacco water and lime water is perhaps the best remedy which can be used. Tobacco smoke is effective, but not so easily applied. Drenching with brine is also recommended.

The larva of the European Cabbage Butterfly (*Pieris rapæ*) is known throughout Europe and America on account of the

great losses resulting from its ravages. The damage it has done in the United States is to be estimated by the millions of dollars. All have seen the small white butterflies which flit about our gardens, and the smooth, bluish-green caterpillars produced by them. They are not easily destroyed, though a great many remedies have been used.

Pyrethrum mixed with flour or dust, sifted upon them, or mixed with water, sprinkled upon them, has proven effectual. Paris green may be used in the same way; but I would not use it after the cabbages have headed, since there is danger of poisoning. However, it is washed away by rains, and the plant unfolding from the center, as it heads will likely be free from poison.

The kerosene emulsion, made by mixing equal parts of kerosene and milk (sweet or sour), and diluting with eight or ten parts of water, is one of the best remedies available.

There are numerous other insects which are doing great damage, but the limits of the hour will permit only a mere mention of some of the worst. The leaves of the apple-tree have been besieged by canker-worms, several leaf-rollers and many other leaf-eating insects. The fruit is badly damaged by curculios and other worms or grubs. The body of the tree is injured by several borers. The roots are badly infested by the apple-root louse, one of the worst enemies of the young orchard. The peach-tree has been greatly injured in many places by the peach-borer. Fully half the pears examined are breeding curculios or other insects. Nearly all the plums examined bear the crescent symbol of the plum curculio. Quinces last year were badly infested, and in some places nearly ruined for use, and we may expect the same this year. Peas were badly infested last season by two species of pea weevil. One lot examined had 96 per cent injured by them. Beans were injured almost as badly by the bean weevil. Watermelons, cucumbers, etc., are reported badly injured by the striped cucumber beetle. Late corn last year was seriously injured by the corn-worm or boll-worm, and we may reasonably expect it

again this year. The cotton-worm usually works great injury to the crop in all the cotton-growing States, sometimes causing a loss of millions of dollars, and we may expect it again.

But enough, enough to prompt us to ask sometimes, shall there be anything left? enough to prove to all that the study of Economic Entomology is not such an insignificant thing after all, and that an enterprising, wide-awake entomologist can find something to do in Tennessee.

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APPENDIX B.

ECONOMIC ENTOMOLOGY.

[A Paper read before the East Tennessee Farmers' Convention, At Knoxville, May 19, 1885.]

It has been thought by some that the study of insects is a little thing and unworthy the attention of a man of brains. It has been thought that for an able-bodied man to spend his time catching insects, or "bug-hunting," as some are pleased to term it, is a masterpiece of foolishness.

But when we consider insects are as the sands of the seashore in numbers, and consider also the millions of dollars worth of vegetation they annually destroy, it is perceived the study of entomology is no little thing, nor is it lacking in importance. Entomology is of interest to the farmer above every other class of men, because he first sees the onward march of insects, like a mighty army, as they sometimes come, and he first sees the desolation which lies in their wake. Bonds and railroad stocks and political issues they let alone, assiduously plying their vocation, "instant in season and out of season," "through evil as well as good report."

It may not be unprofitable to inquire as to the number of injurious species known, and the extent of insect injuries. It is estimated that the annual loss to the farmers of the United States from this cause amounts to nearly \$400,000,000. Matthew Cook, of Sacramento, Cal., estimates that during the last five years the damage to fruits of that State amounts to no less than \$2,000,000. Some years ago, Dr. T. W. Harris stated that in Massachusetts, there were probably not less than 4,800 species of insects, or four for every species of plant in the State.

The number of insects injurious to forest and shade trees is truly wonderful. In the United States there are between 200

and 300 which injure the oak, while Central Europe claims more than 500 which feed upon that one tree. Our hickory is food for 100 species, the willow as many more. The pine has another hundred, while dozens of other trees are besieged by their scores of insect foes. Nothing can escape their ravages, from the tiniest blade of grass or flower which blushes unseen in the wilderness, or the mosses and lichens which struggle for a meager existence in the cleft of the rocks, to the mightiest and proudest oak or loftiest pine that towers to meet the sun. Sometimes they come like the onward march of armies, as in the days of Pharaoh, till no green thing is left in all the land of Egypt. Those who have visited the battlefields and bivouacs of the Kansas grasshopper can scarcely think this over-drawn. Having finished a flourishing wheat field, many a time have the chinch bugs been seen in myriad millions to march into an adjoining corn field and cover it row by row, till it droops and withers and dies, as if swept by an Asiatic monsoon.

Coming nearer home, we find that one-tenth of all the wheat crop in Tennessee last year was destroyed by the Hessian fly, as shown by the statistics of the Commissioner of Agriculture.

It might be thought at first that so small a thing as the beetle could do but little damage to whole forests of tress. In 1876 it was reported that the spruce in the northern part of Maine, on the branches of the St. John River, was beginning to be infested by one of the wood-boring beetles, a species of *Bostrichus*; and in three years at least one-half the marketable spruce was dead, and unfit for manufacturing purposes; and the loss was rated at \$1,500,000.

The Hon. D. W. Taylor reports that in some places in the Green Mountains of Vermont, fully one-eighth of the spruce has been killed by insects. In some counties of Virginia fully half of the chestnut and spruce timber has been destroyed.

I have no statistics in regard to the injuries to the forests of our own State; but I see no reason why they should be exempt, more than forests in other States.

It is not surprising the damages are so great, when we consider the great number of the beetles, and the rapid increase of

their progeny. Some one estimates that the female borer, *Bor-trichus typographicus*, within three years will have an off-spring of 729,000,000 females, and the forest will have fed 1,506,600,060 of the progeny of this one parent.

But it would be useless to delineate the injuries of insects, if there are no remedies by which their ravages may be checked. It may sometimes seem that the insinuating foes defy our marshaled phalanges, and we may as well retire from the field and acknowledge their supremacy. Not yet. While we may not hope to drive them from the land, we can at least keep them at bay while we defend our "vine and fig-tree." It is thought by scientists that no less than \$20,000,000 could be saved annually to the farmers of our own country by proper use of the means at hand.

The remedies to be used are of two kinds—natural and artificial. In regard to the latter, the limits of this paper will allow me to give only a passing notice, since I cannot here speak of the different injurious species in detail, and give their specific remedies. It seems more profitable now to speak of the natural agencies which we may more fully utilize.

It behooves us that we should protect the enemies of insects; such as birds, carnivorous insects, insect parasites and insect-eating animals in general.

The good done by some species of birds can hardly be over-estimated. With the exception of marine animals, birds form the most numerous class of the great sub-kingdom of vertebrata, just as insects are the most abundant of the invertebrata.

From S. A. Forbes, a well-known scientist of Illinois, some of the following facts in regard to this subject in that State are gleaned. I have no statistics in regard to the matter in our own State, and have had no time to make investigations :

By careful estimates it is found that there are, on an average, three birds to an acre for the entire State during six months in the year. About two-thirds of the food of birds consists of insects, and this will require about twenty insects, or insects' eggs per day, giving a total for the year of seven thousand two

hundred per acre, or two hundred and fifty billions for the State. Placing one to the square inch, forty thousand acres would be covered.

Taking the estimate of ten thousand insects to the acre, if the operation of the birds should be suspended, the increase of insects the first year would be about 70 per cent.; then by geometrical ratio the second year we would find about three-fold increase, and in twelve years there would be one to every square inch of land in the State.

But there is another feature in the case. Birds have a tendency to check oscillations of injurious insects. When a certain species suddenly becomes very abundant, birds at once begin to feed more heavily upon that species.

Prof. Forbes examined the contents of the stomachs of one hundred and forty-six birds, taken on two successive years in an orchard very badly infested with canker-worms. May 24, 1881, fifty-four birds were taken, representing twenty-four species; May 20, 1882, ninety-two birds were taken, representing thirty-one species. Of twenty-seven thrushes shot, 96 per cent. of their food consisted of insects, 16 per cent. of which was canker-worms. Ninety-eight per cent. of the food of the blue-birds was insect food; 12 per cent. of that was canker-worms. Chickadees had eaten nothing but insects, 61 per cent. of which was canker-worms. Wrens had eaten 97 per cent. of insect food, nearly half of which was canker-worms. About two-thirds of the food of the warblers was composed of canker-worms. The wax-wings had taken almost nothing but canker-worms. One specimen of the swallows was taken; the food was composed of insects entirely. The finches (commonly called seed-eaters) had taken 91 per cent. of insects. Even two-thirds of the food of five species of black-birds was insects. Nine specimens of fly-catchers had eaten only insect food, 15 per cent. of which consisted of canker-worms.

From several specimens taken elsewhere, it was shown that the birds in the orchard infested with the canker-worms had eaten more than their ordinary amount of insect food by about as much as the per cent. of canker-worms eaten.

There are two things to be seen from the above; first, what species of birds are most destructive to insect life; and second, that they have a tendency to hold in check or restrain any oscillations of species which are likely to become very injurious.

It is worthy of note, also, that the greater part of insect ravages is done by a few species, existing for a time, in numbers far above the average, and soon to retire again to a much lower limit.

Though some of the foregoing facts have been based upon experiments made in another State, there is no reason for supposing they are not equally correct for this State, especially so since in our milder climate there is likely to be a greater number of insects for a greater number of months of the year; also a greater number of species, both of resident birds and of sojourners, for a longer time.

With these facts before us, we cannot fail to realize that the birds are among our best insecticides. And we must not fail to note, also, that by such thoughtless and wanton destruction of birds as is continually going on, a great injury is done our country. A few months ago the *Florida Naturalist* stated that during the past season "at least one hundred thousand of three or four species of Turns which frequent our coast, have been sacrificed for the votaries of fashion, while many other species have been gathered in proportionate numbers." And all this is to satisfy the demand for birds to be worn on hats.

There ought to be a law prohibiting such wanton destruction of birds of any kind; and especially there ought to be a strict law prohibiting the destruction of such birds as feed upon insects. I have consulted the Statutes of Tennessee, and find there is no law of any kind bearing upon this point, except in certain counties. About a dozen counties have laws forbidding the destruction of any song bird, or birds which feed upon insects which destroy fruit trees; also forbidding the destruction of birds' nests.

In some of the countries of Europe the destruction of birds for commercial purposes resulted in such an increase of insects

that the Commissioner of Agriculture called upon the officers of the various provinces to enforce the protection of birds.

Another remedy at hand is found in certain species of beneficial insects, such as the "lady-birds" or "lady-bugs," which are very useful in destroying certain noxious insects. Hence, these should not be destroyed. Likewise there are many species of parasites which should be fostered and reared and transported.

Very much could be done toward lessening the amount of insect injuries by taking measures against the transportation of insects with fruit or vegetables. Some of our most troublesome pests have thus been imported from Europe. California has recently passed a law bearing upon this subject. It provides, among other things, that it shall be the duty of every owner of an orchard or nursery to disinfect all fruit trees, etc., grown, that are infested with insects, or germs thereof; that all fruit boxes which have been used in shipping fruit shall be disinfected; that all fallen fruit containing insect pests must be destroyed. A large penalty is affixed for the violation of these provisions.

As to the artificial remedies, a few general hints may be given in this connection, since it would require volumes to treat all the injurious species and give remedies.

Many of the States have an Entomologist, working under the direction of the State Board of Agriculture, whose business it is to study the habits of noxious insects, suggest remedies, etc. Valuable service could be rendered to the farmers of Tennessee, at a small cost, in this way. The Entomologist might visit many infested regions, report injuries, etc. Specimens of the pests and plants injured could be sent him. He could issue bulletins from time to time, calling the attention of farmers to the depredators, and issue an annual report. Besides, the agricultural press of the State will be glad to allow him space in their columns. In this way a large number of the farmers of the State could be reached and benefited. Scientists say that \$20,000,000 could be saved to our country every year by proper action in this matter.

Ohio is just now looking to the appointment of a State Entomologist. At a recent meeting of one of the horticultural societies, a unanimous resolution was adopted, urging the State Board of Agriculture to take measures to bring about an immediate appointment of such an officer.

Though in this respect we are behind some other States farther north and east, it is to be hoped that Tennessee will thoroughly awake. Our people are growing in zeal in other branches of industry. East Tennessee, noted alike for the extent and variety of her resources, and her climate, whose fame is spread beyond the seas, is inviting men of enterprise from the North, who are helping to develop her industries. But a climate so congenial and inviting to man is also congenial to the festive bug and conducive to his rapid multiplication. It behooves us, therefore, that we undertake to fall upon some plan by which we can make him most heartily unwelcome.

[The above was written about a year and a half ago. Since that time a wide-spread interest in Economic Entomology has sprung up. The farmers of the State are asking for remedies, and the State is in a fair way to be greatly benefited. The Commissioners of Agriculture and the agricultural press are taking advanced ground upon the question, and much practical good will result.—*E. W. D.*]

PLATE I.



FIG. 1.

FIG. 2.



FIG. 3.



FIG. 4.



FIG. 5.



FIG. 6.

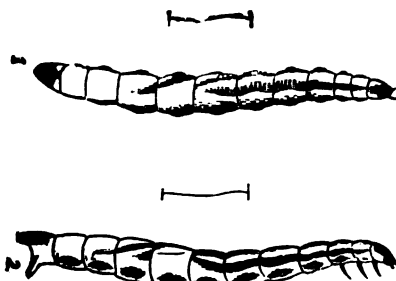


FIG. 7.



FIG. 8.

PLATE II.



FIG. 1.

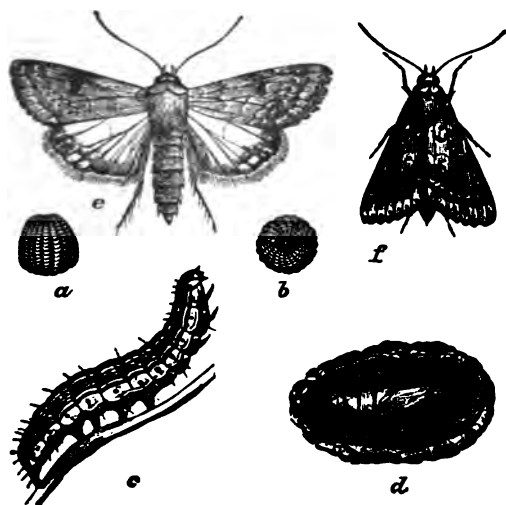


FIG. 2.

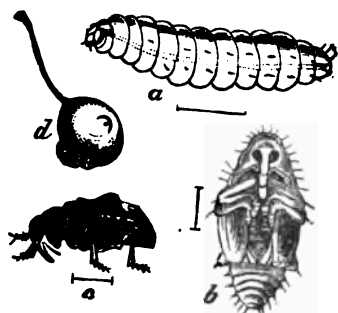


FIG. 3.

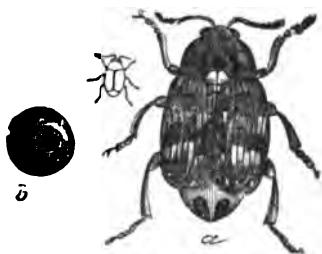


FIG. 4.

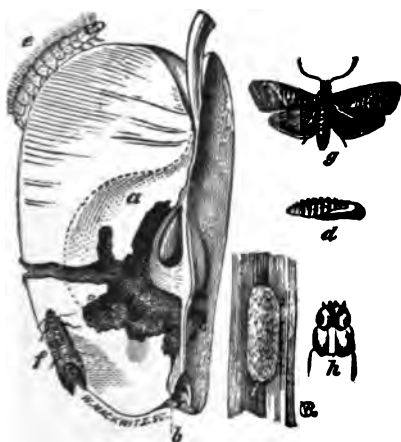


FIG. 5.

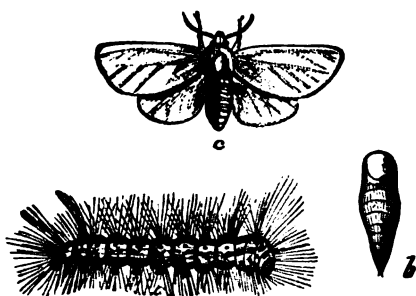
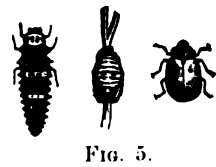
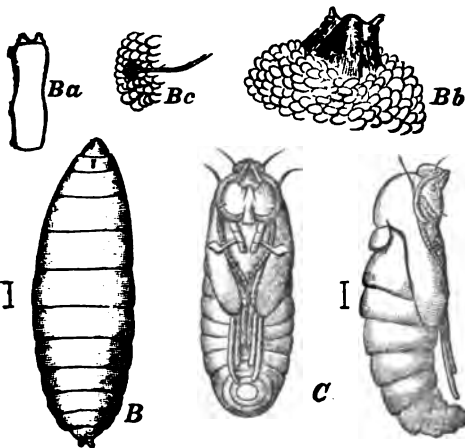
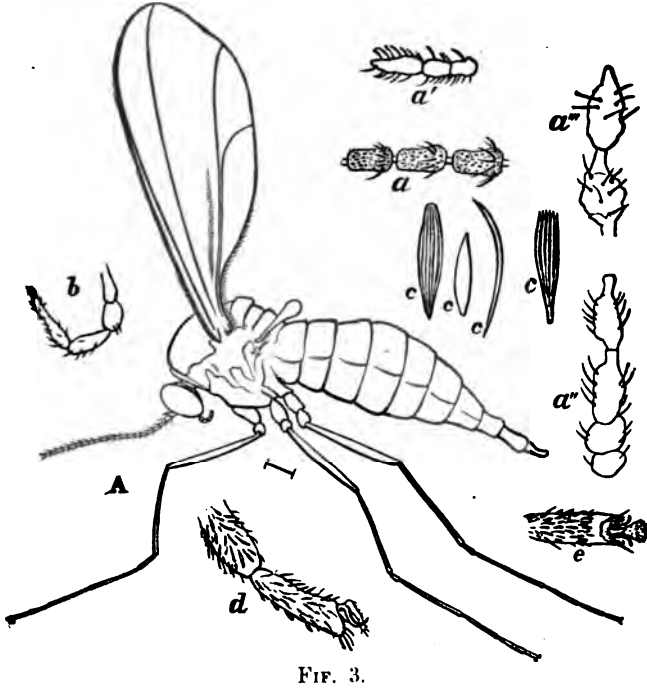
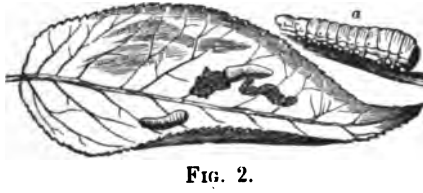


FIG. 6.

PLATE III.



PLATE IV.



EXPLANATION OF PLATES.

PLATE I.

- Fig. 1.* The Reaping Rustic, *Agrotis messoria*. The larva at the left is the Dark-sided Cut-worm.
- Fig. 2.* The Gothic Dart, *Agrotis subgothica*; imago of the Dingy Cut-worm.
- Fig. 3.* Colorado Potato Beetle, *Doryphora ten-lineata*; *a*, eggs as placed upon the vine; *b*, the larva feeding; *c*, pupa; *d*, imago; *e*, one of the elitra magnified.
- Fig. 4.* Imported Cabbage Butterfly, *Pieris rapæ*, female.
- Fig. 5.* Same, male.
- Fig. 6.* *a*, Larva of *Pieris rapæ*, the green Cabbage-worm; *b*, pupa of the same.
- Fig. 7.* Larva of the Striped Cucumber Beetle, *Diabrotica vittata*, greatly magnified; the small lines show the actual length of the insect; 1, back view; 2, side view.
- Fig. 8.* The mature beetle of the same.

PLATE II.

- Fig. 1.* The Canker-worm, *Anisopteryx pometaria*; *a*, cluster of eggs; *b*, same magnified; *c*, full-grown larva; *d*, cocoon containing pupa; *e*, pupa; *f*, male moth; *g*, wingless female slightly enlarged.
- Fig. 2.* The Corn, or Boll-worm; *a* and *b*, the egg magnified; *c*, full-grown worm; *d*, section of cocoon, showing pupa within; *e*, moth with wings extended; *f*, moth with wings closed.

Fig. 3. The Plum Curculio, *Conotrachelus nenuphar*; *a*, larva magnified, the real length shown by the hair line at the side; *b*, pupa magnified; *c*, perfect insect, magnified; *d*, plum, showing the crescent mark made by the female in which to deposit the egg.

Fig. 4. The Pea Weevil, *Bruchus pisi*; *a*, beetle magnified, the natural size shown by the outline at the right; *b*, a pea from which the beetle has escaped.

Fig. 5. The Codling Moth, *Carpocapsa pomonella*; *a*, burrow made by larva; *b*, showing entrance of the young larva into the apple; *d*, pupa; *e*, larva; *f*, moth, wings closed; *g*, moth, wings expanded; *h*, head of larva magnified.

Fig. 6. The Fall Web Worm, *Hyphantria textor*; *a*, larva; *b*, pupa; *c*, moth.

PLATE III.

The Hessian Fly, *Cecidomyia destructor*, and its transformations. On the left is a healthy stalk of wheat, on the right a dwarfed and withered one; *a*, egg of Hessian fly greatly magnified; *b*, larva, enlarged; *c*, the flax-seed, or pupa case; *d*, the pupa; *e*, fly, natural size, laying its eggs upon the leaf; *f*, female, magnified; *g*, male, magnified; *h*, flax-seeds between the leaves and stalks; *i*, Chalcid, or Ichneumon parasite of Hessian fly, male, enlarged.

PLATE IV.

Fig. 1. Cherry or Pear-tree Saw-fly, *Selandria cerasi*, imago.

Fig. 2. Cherry, or Pear Slug, larva of above, full size shown at *a*; smaller ones shown upon the leaf.

Fig. 3. A side view of the female Hessian fly, greatly enlarged, *a*, *a'*, *a''*, *a'''* show parts of antennæ highly magnified; *b*, a maxillary palpus; *c*, scales from the body and wings; *d*, *e*, side and vertical view of the last joint of the foot.

Fig. 4. B, larva of Hessian fly magnified, with the "breast-bone" in the second ring next to the head; B *a*, the breast-bone highly magnified; B *b*, head from beneath, enlarged; B *c*, larval spiracle and its tubercle and trachæ leading from the spiracle; C, side and front view of the pupa, or chrysalis. The line beside the complete figures denotes the natural length of the insect.

Fig. 5. Lady Beetle, *Hippodamia convergens*, showing larva, pupa, and perfect beetle.

REPORTS

—OF—

JO. C. GUILD,

INSPECTOR OF MINES.

1885-86.

NOTE.

The operators of mines in Tennessee have come to regard the mining law as inoperative and without effect, and in this belief regard themselves as safe from the interference of the State in the matter of the welfare of miners.

It has been with some difficulty that I have been able to convince them that such is not the case.

It has been my endeavor to deal equally with all, and the object of this report is to make known the condition of the mines as regards ventilation and safety of miners.

In some cases other data concerning the mines are given. When this information is limited or left out altogether, it is not on account of any neglect on my part, but is the choice of the Superintendent in charge.

JO. C. GUILD,

Inspector of Mines.

FIRST SEMI-ANNUAL REPORT.

NOVEMBER 5, 1885.

TENNESSEE COAL, IRON AND RAILROAD CO.

OFFICERS OF THE COMPANY.

J. C. WARNER, President, Nashville.

NAT. BAXTER, Vice-President, Nashville.

J. BOWRON, Secretary and Treasurer.

A. M. SHOOK, General Manager, Tracy, Tenn.

E. O. NATHURST, Superintendent, Tracy, Tenn.

F. P. CLUTE, Resident Engineer, Tracy, Tenn.

The mines operated by this company are the largest single mining operation in the State.

The mines are known as the Sewanee mines, and are located at Tracy City, Grundy County, Tennessee, on a broad-gauge branch road, twenty miles long, owned by the company.

This road connects with the Nashville & Chattanooga Railroad at Cowan.

The mines now being worked are seven in number, viz: No. 1, No. 2, No. 3, Bats' Nest, Rattlesnake, Lone Rock and East Fork.

In all these are employed 514 miners and seventy-two mules. The output is 31,120 bushels of coal per day.

No. 2, Rattlesnake and Lone Rock are worked by convict labor and the balance by free labor.

The company own and operate iron furnaces both at South Pittsburg and at Cowan, and a great deal of the coke manufactured at Tracy City is used at these points.

The coke plant consists of 500 ovens in operation and thirty-four more under construction. The coke ovens are distributed as follows:

No. 1, No. 2, No. 3 and Bats' Nest mines have 134 ovens; Rattlesnake mines, 66; East Fork, 204; Lone Rock, 96; under construction, 34; total, 534.

At Rattlesnake and Lone Rock mines the coal is coked as it comes from the mines, excepting at times the Rattlesnake coal is screened. Preparations are being made to erect a crusher at Lone Rock chute that will pulverize the coal to dust. At East Fork and No. 1 the coal is prepared for coking by crushing fine, that it may enter the ovens even in size.

Below I give shipments of coke and coal. Previous shipments can be found by reference to Henry E. Colton's report. Shipments from the mines for the year ending December 31, 1883: 126,784.24 tons of coal, and 101,090 tons of coke. Shipments for the year ending December 31, 1884: Coal, 152,307.68 tons; coke, 100,935.12 tons. Below I give shipments for 1885 by the month:

<i>Months.</i>	<i>Coal.</i>	<i>Coke..</i>
January	15,906.82	9,116.80
February	14,411.84	8,190.98
March.....	15,174.80	9,069.88
April.....	11,839.88	7,206.98
May	10,757.00	7,272.76
June	8,446.16	9,463.78
July.....	9,264.76	10,861.14
August	9,789.28	9,394.24
September	8,815.64	9,956.36
October	9,862.92	8,835.62

The number of ovens up to June was 404, which was increased to 500 during the succeeding two months.

The shipment of coke from July 30th to the present time does not account for coke stored on the various coke yards, caused by blowing out one furnace at South Pittsburg.

The ovens are on 72-hour coke. All the coke ovens are of the ordinary "bee-hive" oven, differing mainly in material used in construction.

Experiments will be made in last ovens constructed to heat the bottoms by waste gases, etc., and to improve the quality of coke.

Average charge of ovens, 100 bushels; average yield of coke from 48 hours burning, 56 bushels (about).

LONE ROCK MINE.

Inspected September 29, 1885; barometer, 28.39; temperature, 70°; cloudy; stiff breeze blowing from the west.

Capt. J. L. Kennedy and A. D. Hargis, mining "bosses."

The ventilation of this mine is effected by an upcast shaft and furnace, and the mouth of the mine is the intake for the air, which passes around the workings and back to the upcast, near the mouth of the mine.

The velocity of air at the intake (average of three observations) was 248 feet per minute, and 12,896 cubic feet passed every minute.

On the seventh cross-entry on the west of the main entry the air was moving with a velocity of 72 feet per minute, and 2,016 cubic feet of air passed every minute.

On the third cross-entry, on the east side of the main entry, the velocity of the current was 129 feet and amount of air 5,820 cubic feet every minute.

Velocity of current near the upcast, 415 feet per minute; number of cubic feet, 10,375 per minute. •

There are twenty entries and air-ways under way, each of which is driven about twenty-four yards per month.

The drainage of the mine has not yet been provided for, as no water of consequence has yet been encountered.

In the mine are 130 miners and 15 mules. (Convict labor.)

NUMBER TWO MINE.

Inspected October 30, 1885; barometer, 28.28; temperature, 52°; cool and breezy.

Capt. J. L. Levan, mining "boss."

This mine is connected with No. 1, No. 3 and Rattlesnake, and the drainage is by gravity through these mines.

The main work in the mine is on the left of the main entry, and the ventilation is effected by an upcast shaft 83 feet high and 9 or 10 feet in diameter, with furnace at the bottom. The air comes from Rattlesnake mine, through an entry connected with the main entry of No. 2, and passes up on the main entry and across to the workings on the left of the main entry and back to the main entry and to the upcast.

Velocity of air entering main entry from Rattlesnake, 163 feet, and amount, 4,401 cubic feet per minute.

Near the upcast the velocity of the air was 118 feet, and amount 4,779 cubic feet per minute.

The air at the face of one entry was bad, because the air course had not yet been connected, but at the time of inspection it only lacked 10 or 12 yards. No men were working here, except one man on the air course.

At present but six entries and air-ways are being driven, but this number will be increased before the end of the year.

Number of miners employed, 50; number of mules employed, 10. (Convict labor.)

NUMBER ONE MINE.

Inspected October 30, 1885; barometer, 28.28; temperature, 52°.

Capt. J. L. Levan, mining "boss."

This mine is the oldest at this place, and is now worked by free labor. The drainage is entirely by gravity through several openings to daylight and numerous connections with other mines.

No artificial means are used to ventilate this mine, natural ventilation being entirely depended upon.

There are now ten entries being driven, two of which are under way to the surface for the purpose of improving the ventilation and drainage of the mine.

In some of the entries the air was bad, no current passing at all.

Men employed in mine, 130. (Free labor.)

RATTLESNAKE MINE.

Inspected October 31, 1885; barometer, 28.45; temperature, 48°.

J. L. Levan, mining "boss."

Rattlesnake mine is adjoining No. 2 and No. 3 Mines of the east and southeast, and the air for the ventilation of No. 2 passes through Rattlesnake.

The air for the ventilation of this mine passes in on the main entry and is turned up on the entries on the right, of which there are three, and passes back on the main entry and through an air course to mine No. 2, and to the upcast shaft of that mine.

The intake, where the air passes into the first entry on the right, was moving with a velocity of 138 feet per minute, and furnished 4,447 cubic feet per minute, which passes around and to No. 2 mine.

The current of air does not pass quite close enough to the faces of entry No. 1 on the right and the main entry, but the air course was nearly finished. There are ten entries and air courses under way.

The drainage of the mine is entirely by gravity. A large part of the mine is flooded, but the water cannot rise above its present level.

Fifty miners are employed in this mine and six mules. (Convict labor.)

• EAST FORK MINE.

Inspected October 31, 1885.

J. L. Kennedy, mining "boss."

This mine is really composed of three separate mines, which are not connected at all under ground.

These mines are known as the Main Works, Petersburg and Johnson Entry, which, combined, form East Fork mine.

In no part of this mine is any means used to ventilate it, there being numerous openings to daylight, and these being depended upon.

In no part of the mine did I find any actual current of air.

No doubt, under certain favorable conditions, some air might pass into the mine, but as the works are quite extensive this is inadequate for the proper ventilation of the mine.

MAIN WORKS.

A large Deane pump, together with numerous openings, is used to drain the mine.

Fifty men are employed in this mine and ten mules.

Thirteen entries and air-ways are being driven. (Free labor.)

PETERSBURG.

This mine has three openings to surface and is drained through these.

There are forty men and five mules employed, and four entries and air courses under way. (Free labor.)

JOHNSON ENTRY.

This part of the mine is about worked out and has several openings to daylight. Drainage by gravity.

Forty-six men and six mules are employed. (Free labor.)

MINE NUMBER THREE.

This mine is adjoining No. 2 on the southeast, and is under

contract to "work out." But little is being done, all the work consisting in robbing stumps and pillars.

BATS' NEST MINE.

This mine is being robbed by contract the same as No. 3, and 18 men and 3 mules are employed. (Free labor.)

In conclusion, I will say that I found all the mines being worked by convict labor in very good condition as to ventilation and drainage, but in mine No. 1 and in East Fork mine the ventilation was very poor.

ORDER ISSUED.

NASHVILLE, TENN., November 5, 1885.

To A. M. Shook, General Manager for Tennessee Coal, Iron & Railroad Company, Tracy City, Tenn..

As Inspector of Mines for the State of Tennessee, I respectfully call your attention to the following facts:

On the 30th day of October, 1885, I made an inspection of mine No. 1, operated by the Tennessee Coal, Iron & Railroad Company at Tracy City, Tenn. I found no regular current of air moving through the works and no adequate means provided to produce the same.

On the 31st of October, 1885, I made an inspection of the mine operated by the Tennessee Coal, Iron & Railroad Company, near Tracy City, Tenn., known as East Fork mine, and found no perceptible current of air circulating through the works of said mine, and no means provided to produce the same. You have thus violated an act of the Legislature, passed and approved April 7, 1881, entitled "An act to provide for the ventilation of coal mines and collieries, and the protection of human life therein, of the State of Tennessee."

Section 7 of the act provides "That the owners or agents of every coal mine or colliery shall provide and establish for every coal mine and colliery an adequate amount of ventilation, and not less than fifty-five cubic feet per second of pure air, or 3,300 cubic feet per minute, for every fifty men at work in such mine,

and as much more as circumstances may require, which shall be circulated through to the face of each and every working-place through the entire mine."

I would also call your attention to section 4 of the same act, which reads as follows:

"That any of the courts of law or equity of this State having jurisdiction where the coal mine or colliery proceeded against is situated, upon application of the inspector of coal mines or colliers of the proper district, acting in behalf of the State of Tennessee, *shall prohibit* by injunction, or otherwise, the working of any mine in which any person or persons are employed in working, or are permitted to be for the purpose of working, in contravention of the provisions of this act, and may award such costs in the matter of the injunction or other proceedings as the court may think just."

I, therefore, as inspector of mines, will consider it my duty to file an injunction in the court having jurisdiction where your coal mines are situated to enjoin you from working the said mines, and to obtain such costs as are provided for in the above section if steps are not immediately taken to provided for sufficient ventilation of the mines herein mentioned.

For further information I refer you to a copy of the act which I will mail to you with this order. Yours respectfully,

Jo. C. GUILD, Inspector of Mines.

ETNA COAL AND COKE COMPANY.

OFFICERS OF THE COMPANY.

DR. WM. MORROW, President, Nashville.

D. B. PILLSBURY, General Manager, Whitesides.

J. T. HILL, Secretary, Chattanooga.

Post-office and Station, Whitesides, Marion County, Tenn.

The mines of this company are located in Marion County, Tennessee, one and three-quarters miles from the Nashville & Chattanooga Railroad and fourteen miles from Chattanooga.

The mines were first worked in 1852 by an Eastern company, and since that time have been operated by several companies. The present company was organized in August, 1881.

The seam now worked is known as the Kelly seam, and is considerably above the Sewanee seam. This is the only place in the State where it has been opened.

The coal mined by this company is sold for blacksmithing purposes, and is now fully established as the best blacksmith coal in the South, and fully equal, if not superior, to any in the United States.

The company has sixty-five coke ovens, and make a good quality of foundry coke.

The following analysis of the coal was made by Professors Pohle and McGrath: ●

Fixed carbon.....	74.200
Volatile matter.....	21.100
Ash.....	2.700
Sulphur.....	.700
Water	1.300
Phosphorus.....	.005

Mine inspected October 19, 1885. Barometer, 28.62; temperature, 72°.

The main entry of this mine extends entirely through the ridge, and there are numerous cross-entries on either side, but all of these are deserted except the two last cross-entries, on the left of the main entry, and these are known as entries No. 12 and No. 13.

The ventilation of the mine is effected by means of an up-cast shaft forty feet high, and furnace with a heating surface of five by five feet. This furnace and shaft are located on the main entry, near the point at which it breaks through the ridge.

The mine has three or four openings, and the air passes in at one of these and is conducted through an air-way to the head of entry No. 12, from which it passes across to entry No. 13. The air passes on entry No. 13 to the main entry, and from there to the upcast.

The velocity of air at the upcast was 833 feet per minute, and 11,988 cubic feet passed up every minute.

There are two cross-entries being driven between entries Nos. 12 and 13, which are not yet finished, and with the exception of these, there is a good current of air in all parts of the mine that is being worked.

TABLER-CRUDUP COAL AND COKE COMPANY.

OFFICERS.

J. H. TABLER, President, Chattanooga.

THOS. PARKS, Vice-President and Secretary, Daisy.

D. G. CRUDUP, Treasurer, Chattanooga.

A. McRAE, Manager, Daisy.

Inspected October 2, 1885; barometer, 28.57; thermometer, 70½°.

Post-office and station, Daisy, Hamilton County, Tennessee, eighteen miles north of Chattanooga, on the line of the Cincinnati Southern Railroad.

The coal mine owned and operated by this company is situated on the west side of the Cincinnati Southern Railroad, and at the top of an incline 1,800 feet long and 560 feet in vertical height.

A main entry 925 feet long has been driven in on the outcrop toward the west. This entry "goes to the dip," the face being thirty feet below the mouth. Eight cross-entries are turned from the main entry—four on either side.

The mine is ventilated by means of an upcast shaft, situated near the mouth of the mine. This shaft is eighty-three feet high.

The current of air passes in at the mouth of the mine, and by doors is turned in the first entry on the left, from which it passes successively to all the entries on this side, then around the face of the main entry and through the entries on the right to the upcast shaft.

No fire is kept at the bottom of the upcast, as the current is sufficient to supply air to the few men at work without this.

The velocity of the air passing in the mouth of the mine was 65 feet per minute, and supplying the mine with 4,550 cubic feet of air per minute.

Velocity of air in entry No. 5, 233 feet per minute; number of cubic feet of air passing to upcast at time of measurement, 4,907 per minute.

Velocity of air current in last entry on the right, No. 7, 83 feet per minute; number of cubic feet of air, 3,820 per minute.

Thus showing that 1,230 cubic feet of air had been lost by leakage. Nevertheless, there is left an abundant supply for the few men now at work in the mine, which is 10 men and 2 animals.

There is some water in the mine, but I am informed a syphon will be put in immediately.

The average thickness of the vein is three and one-half feet.

The present company was incorporated in 1881, and have 5,000 feet of entry, 7,000 acres of land, and one and one-half miles of narrow-gauge track. Since July last considerable improvements have been going on. There is now in process of construction one and one-quarter miles of broad-gauge track and fifty coke ovens.

Output of mine last season was 30,000 tons, and the management this year expect it to reach 200 tons per day.

The following analyses were made by Dr. Lupton:

COAL.

Volatile matter.....	30.139
Fixed carbon.....	59.723
Ash, white.....	9.443
Sulphur.....	1.140

COKE MADE IN LABORATORY.

Fixed carbon.....	85.000
Ash.....	13.000
Sulphur.....	1.000
Phosphorus.....	.180

On the property of the company is a fine deposit of clay and two veins of iron ore, one fifty inches and the other four feet thick.

Mr. Parks informs me that there are more orders ahead for coal and coke than he can possibly fill.

 THE SODDY COAL COMPANY.

OFFICERS OF THE COMPANY.

M. H. CLIFF, President, Chattanooga.
 J. T. WILLIAMS, General Manager, Chattanooga.
 J. W. CLIFF, Secretary, Soddy.
 A. LLOYD, Sr., Superintendent, Soddy.
 M. L. JENKINS, Assistant Superintendent, Soddy.
 Post-office, Soddy, Hamilton County, Tenn.; Station, Rathburn, Hamilton County, Tenn.

The mines of this company are located about one mile from Rathburn, on the line of the Cincinnati Southern Railroad, twenty-one miles from Chattanooga.

The company have here three miles of narrow-gauge track—for engine. This track reaches the Tennessee River, and coal and coke is shipped by both river and rail.

One hundred and fifty coke ovens are continually employed in the manufacture of coke, which, with the coal, is shipped to Georgia, Alabama, Louisiana, Mississippi and Texas.

The main mines of the company are on the right of the hollow, going from the railroad, but the company has lately opened the vein on the left, and twenty-two men are now employed in this opening.

There is now in all twenty-six miles of entry, and the coal is worked so that the natural dip of the vein furnishes drainage.

Mine inspected October 3, 1885. Barometer, 28.80; temperature, 69° F.; cloudy and slight rain.

The main work is in Nos. 1 and 3—No. 2, between Nos. 1 and 3, being deserted.

All of these openings are connected through the coal.

The ventilation of all three mines is effected by an upcast shaft and furnace on the left of the entrance of No. 3.

NUMBER ONE MINE.

There are thirteen cross-entries turned from the main entry of No. 1, and the air passing in the mouth of No. 1 is turned by doors up the first entry on the right, and from there it passes successively through all the entries on this side and around the face and through the entries on the left of the main entry, and through No. 2 (now deserted), to the upcast at No. 3.

The current passing into the first entry on the right attained a velocity of eighty-eight feet per minute, and furnished 3,520 cubic feet of air per minute.

By measurement I found a leakage of 1,095 cubic feet per minute under the door on the main entry, which I saw remedied before I left the mine.

The air at the junction of the last cross-entry with the main entry attained a velocity of seventy-eight feet per minute, and furnished 2,840 cubic feet of air per minute.

Air in cross-entry No. 9 on the left attained a velocity of 118 feet per minute, and furnished 2,124 cubic feet of air.

The return from No. 1 measured at air crossing of main entry of No. 3, on its way to the upcast, showed a velocity of 1,212 feet per minute, and furnished 13,332 cubic feet of air.

As this amount was so much greater than the amount found in No. 1, it is evident that a great loss is met with by leakage in passing through the old works of No. 2. I ordered this matter attended to at once.

In this mine are 110 miners.

NUMBER THREE MINE.

In this mine are seven cross-entries, all turned to the left of the main entry.

The air passing in the mouth of the mine passes to the face of this main entry and back to the cross-entries and to the upcast, which is situated on the first cross-entry on the left. This upcast shaft is 109 feet high with large furnace at the bottom.

The bottom of this upcast shaft is thirty feet above the opening of No. 1.

The intake at mouth of No. 3 reached a velocity of 338 feet per minute, and furnished 6,788 cubic feet of air.

The air course between cross-entries Nos. 5 and 6 was contracted much too small, but this defect was being remedied.

There were some leaks in brattices, which I ordered stopped at once.

In this mine are sixty miners.

WALDEN RIDGE MINING COMPANY.

[*Under Management of the Soddy Coal Company.*]

Post-office, Sale Creek, Hamilton County, Tenn.; Station, Rock Creek, Hamilton County, Tenn.

W. R. LLOYD, Sale Creek, Superintendent.

The company have been carrying on work at this place about four years, and have now 9,655 yards of entry. The mines are one mile from the Cincinnati Southern Railroad, on a broad-gauge spur track.

The company owns here a splendid inlet to Walden Ridge—three creeks, heading within one mile of the mine. A railroad could be built up either and strike good coal.

The output of mines is 2,500 tons a month, and thirty-three coke ovens are used to coke the slack coal.

Two veins of coal are worked by the company, and a single outlet used for both, the upper being only thirty feet above the lower.

The coal of the upper is much harder than the lower, and some is sold for domestic purposes.

Inspected October 5, 1885, barometer, 29.71; temperature, 67°, cool and frosty.

The main entry is 560 yards long, and four cross-entries are all turned to the right, respectively 250, 350, 300 and 175 yards in length. An entry is turned off on the left to the upper vein, on which two rooms are worked.

The mine is ventilated by an upcast shaft fifty feet high and four feet in diameter.

This upcast is located on the first cross-entry on the right.

The air, entering the mouth of the mine, passes down the main entry and up to the upper vein, then back on the main entry and on to the face and back through the cross-entries to the upcast.

Velocity of current at bottom of upcast, 141 feet per minute; number of cubic feet of air, 11,280.

Velocity of current at return from upper vein, 263 feet per minute; number of cubic feet of air, 1,381.

Cross-entry No. 2 is now only 100 yards from outcrop and will soon be driven through.

There has been some neglect about doors, and the air is not carried quite close enough to the face in some of the entries, both of which Mr. Lloyd will remedy immediately.

Lower vein, 40 miners and 4 mules; upper vein, 3 miners and 1 mule.

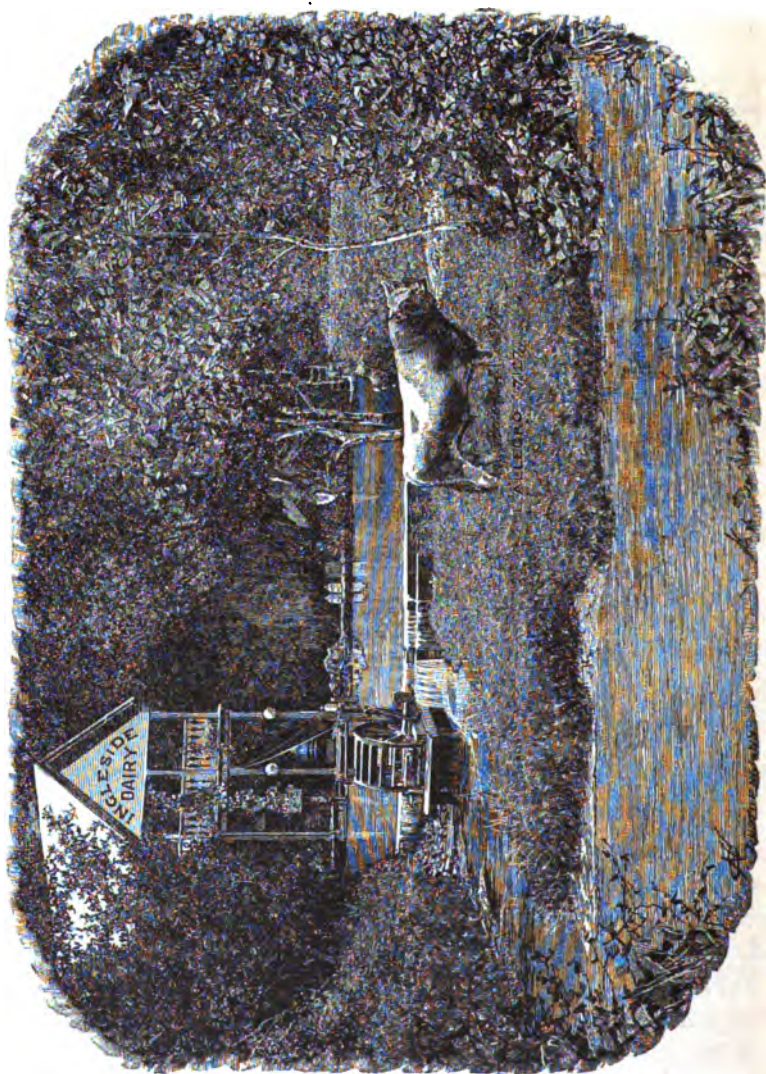
DAYTON COAL AND IRON COMPANY.

Post-office and Station, Dayton, Rhea County, Tennessee.

The mines of this company are two and one-half miles from Dayton, Tenn., on a spur-track, connecting with the Cincinnati Southern Railroad thirty-eight miles north of Chattanooga.

The company is composed of an English syndicate, who own a very fine plant at Dayton for the manufacture of iron.

On account of lack of lamp oil no work at all was going on in the mines at the time of my visit, and, therefore, no inspection was made, but at some early time I will visit Dayton again and make a thorough inspection and report thereon.



ROANE IRON COMPANY.

OFFICERS OF THE COMPANY.

H. S. CHAMBERLAIN, President, Chattanooga.

H. CLAY EVANS, Secretary, Chattanooga.

M. M. DUNCAN, Superintendent, Rockwood, Tenn.

W. L. NELSON, Superintendent of Mines, Rockwood, Tenn.

Post-office and Station, Rockwood, Roane County, Tenn., on the Cincinnati Southern Railroad, seventy miles north of Chattanooga.

The company have located here two iron furnaces, whose output is about ninety tons per day, and coke most of the output of the mines to furnish them with fuel, using 180 coke ovens.

The company have thirteen miles of narrow and broad-gauge track.

They employ in all 300 men. Output of mines is 350 tons of coal per day.

Mines inspected October 6, 1885; barometer, 29.42; thermometer, 63°.

The outcrop of the vein of coal mined by this company shows an inclination on the side of the mountain of about 35°.

The vein has been opened on four levels, all of which are connected through the coal.

Only the three lower levels are now being worked, the upper being deserted.

One opening is being used to bring the coal from the two lower levels, this opening being known as the "tunnel entry."

From a cross-entry on the right of the tunnel entry an incline within the mine leads down to the lower level and the coal is drawn from this part of the mine by means of a wire rope.

Outside the mine on the side of the mountain is another incline leading from the mouth of the upper entry to the mouth of the tunnel entry, down which the coal is lowered from the upper level.

The works on the upper level are known as the "new bank entry."

Only natural means are used to ventilate the mine, the air by natural pressure being forced in the lower opening and passing out above.

The air passes into the mine at the tunnel entry and part passes down to the lower level through two air courses.

This passes back to the middle level and passes through an air course up to the new bank entry.

Here the air is split, part passing out on the upper entry and part down on the entry into the mine and back through air courses and out at the mouth of the deserted level above.

Velocity of air at intake on tunnel entry, 488 feet per minute; number of cubic feet of air per minute, 21,024.

Number of cubic feet of air passing down to lower level through air course near the incline, 1,719 per minute.

Amount of air passing to lower level through air course on left of tunnel entry, 1,672½ cubic feet per minute.

Velocity of air in the air course leading from the tunnel entry to the new bank entry, 348 feet per minute; number of cubic feet of air, 3,132 per minute.

On September 23, an explosion of gas or fire-damp occurred near the face of the tunnel entry. No one was near at the time, and it is not known how the gas was lighted. No one was injured by the explosion, but Mr. Nelson, the Superintendent of the mine, went into the entry to see if any one was there, and was overcome by the after-damp, but fortunately escaped without serious injury.

The explosion blew down several doors and brattices, and as these have not yet been replaced the current of air does not pass near the face of the entry.

As a consequence, the fire-damp has again collected in this entry and the adjoining rooms.

A new air course has been opened from this entry to the new bank entry, and when the doors, etc., have been replaced it is hoped there will be a sufficient current to prevent another collection of gas.

The air is stagnant and bad in the face of the new bank entry (upper level), which is caused by the falling in of the old air course.

The management are now opening up a new upcast, so as to increase the amount of air in the mine.

The following is a copy of an order issued :

Rockwood, October 6, 1885.

To M. M. Duncan, General Manager Roane Iron Company, Rockwood, Tenn. :

As Inspector of Mines, I have to-day fully inspected the coal mines owned and operated by the Roane Iron Company, situated at this place. I find the mine in good condition, with the following exceptions :

1. In the face of the tunnel entry there is a considerable collection of fire-damp or gas without sufficient current of air in this entry to either carry off the gas or render it harmless by dilution.

2. At and near the face of the upper bank entry there is no circulation of air whatever.

Therefore, I, Jo. C. Guild, Inspector of Mines, hereby specify :

1. That no men be allowed by the Roane Iron Company, or agents thereof, to remain in or work at or near the face, or rooms adjacent thereto, of either of the entries above mentioned (tunnel entry and upper bank entry), for the purpose of mining coal until the ventilation of these entries is perfect.

2. That a force of men, not less than two shifts per day, be put to work to drive air-courses, repair doors, etc., on said entries until the same are in good condition.

3. That fans, or some other advisable means be used to supply these men with sufficient air while at this work.

4. That no man be allowed to go near the face of the tunnel entry carrying an uncovered light until the gas at that point is rendered harmless or dissipated by a sufficient current of fresh air.

A failure to comply with this order will lay the persons violating it open to the penalty set forth in section 10 of mining law passed by the Legislature of 1881. Respectfully,

Jo. C. GUILD, Inspector of Mines.

POPLAR CREEK COAL REGION.

Post-office and Station, Oliver Springs, Anderson County, Tenn.

There are several mines here in the radius of three miles, and are all located in Morgan County.

The mines are nineteen miles from Knoxville Junction, which is seventy-nine miles north of Chattanooga, on the Cincinnati Southern Railroad, and are reached by the Walnut Ridge Railroad.

The miners at this place were out on a strike, and no work was being done, and therefore the inspection was deferred till next visit.

The mines are all small and not yet well opened, except the Mt. Carbon Coal Company, which has considerable entry.

The mines are as follows:

Poplar Creek Coal Company, W. S. Geers, Superintendent.
Mt. Carbon Coal Company, W. B. H. Wiley, Superintendent.
Winters Gap Coal Company, Thos. Phillips, Superintendent.
Eureka Coal Company, Thos. Jenkins, Superintendent.
Oliver Coal Company, Jos. Richards, Superintendent.

GLEN MARY COAL AND COKE COMPANY.

OFFICERS OF COMPANY.

GEO. W. DARNALL, President and Treasurer, Lexington, Ky.

J. P. SHAW, Secretary, Lexington, Ky.

JOHN H. CLARKE, Manager, Glen Mary, Tenn.

Post-office and Station, Glenn Mary, Scott County, Tenn.

The mines of this company are located on a narrow-gauge spur track, near Glen Mary, Scott County, 112 miles from Chattanooga, on the Cincinnati Southern Railroad.

The lump coal is sold for domestic purposes, and the slack coal is coked.

Mine inspected October 8, 1885; barometer, 28.92; temperature, 68°.

The mines have only natural ventilation, being located in a spur of the mountain and having numerous openings.

At one opening I found passing out 17,200 cubic feet of air per minute, but, of course, this method of ventilation is very uncertain and cannot be depended on, being dependent too much on the state of the weather and winds.

Two entries are turned off from the main entry parallel, and in these the air is quite close and bad, but Mr. Clarke says these entries will be through the ridge soon, and I requested him to use a fan to furnish the men with air until such is the case, which he agreed to do.

Before the mine proceeds further a system of artificial ventilation must be put in use.

STANDARD COAL AND COKE COMPANY.

OFFICERS OF THE COMPANY.

W. W. WOODRUFF, President, Knoxville.
E. McCROSKEY, Secretary and Treasurer, Knoxville.
J. F. McCLURE, Vice-President and General Manager, Newcomb, Tenn.
F. M. MILLER, Mine Superintendent.

The mines of the company are situated near Newcomb Station, Campbell County, which is on the line of the Knoxville & Ohio Division of the East Tennessee, Virginia & Georgia Railroad.

The company own a broad-gauge spur track, about one mile in length.

The company first commenced opening the mine, September 1, 1883, and shipped the first carload of coal January 19, 1884. Shipped from June 1, 1884, to June 1, 1885, 71,305 tons of coal. Employ now 175 men, and output of mine now is 350 tons per day.

A vein of cannel coal three and one-half feet thick has recently been found here, and is said to be a good burner and free from impurity.

Mine inspected October 10, 1885; barometer, 29.165; temperature, 67° F.

The company has two principal entries leading into the mine.

At the intake on one of these entries the air has a velocity of 130 feet per minute, and furnishes 7,800 cubic feet of air per minute, which is about one-half of the total amount of air. Return to main entry from No. 1 on the right. Velocity of air, 515 feet per minute; number of cubic feet of air, 13,160 per minute.

In the main part of the mine the ventilation is good, but in some of the headings where no work is going on, except on air courses and entries, the air is somewhat stagnant.

The ventilation is now effected by an upcast shaft, seventy feet high and six feet in diameter, with furnace. Heating surface, 6x8 feet.

This company is now perfecting a new system of ventilation by connecting all entries and air courses with an improved furnace at the bottom of a tall upcast shaft. When this is perfected we think the mine will be one of the best ventilated mines in the State.

MINES AT COAL CREEK,

Anderson County, Tennessee, on the Knoxville & Ohio division of the East Tennessee, Virginia & Georgia Railroad.

There are now at this place six mines being worked.

This property is owned by the Coal Creek Consolidated Mining Company.

Two of the mines here are worked by this company, and the balance leased to other companies, paying a royalty of about one cent per bushel.

KNOXVILLE IRON COMPANY.

OFFICERS OF THE COMPANY.

W. R. TUTTLE, President, Knoxville.

W. S. MEAD, Secretary, Knoxville.

JOHN CHUMBLEY, Superintendent, Coal Creek.

J. E. HIGHTOWER, Mine Superintendent, Coal Creek.

These mines are located about one mile from Coal Creek, and have a very fine vein of coal, five feet thick, worked on good system, the work being facilitated by a mining bench.

The output of the mine is 250 tons per day, and the company have a contract to furnish the East Tennessee, Virginia & Georgia Railroad, and ship the balance south.

Mine inspected October 13, 1885; barometer, 29.03; temperature, 65° F.

The mine is worked by a long main entry and twenty cross-entries, ten on each side of the main entry. The ones now being worked are No. 10, on the right, and Nos. 8, 9 and 10 on the left.

The air passes in on the main entry and is turned up No. 10 on the right, and passes back through an air course to the main entry and up No. 10 on the left, and through air-courses to Nos. 9 and 8, respectively. From No. 8 it passes to an upcast shaft, fifty feet high, having a large furnace at the bottom.

The main entry at the mouth of the mine is very large, and although the velocity of the intake was only 220 feet per minute, the amount furnished was 24,640 cubic feet per minute.

The return to main entry from No. 10 on the right had a velocity of 420 feet per minute, and furnished 9,450 cubic feet of air.

The current passing from No. 8 on the left to the upcast is split, and one of these splits shows 6,125 cubic feet per minute.

The return at the upcast shaft shows 24,074 cubic feet of air per minute.

While as to the amount of air furnished and the way it is managed, this mine seems to be one of the best ventilated mines in the State, the whole is spoiled by allowing the smoke from a locomotive which draws the coal from the main entry to pass through the entire workings.

The mine is well drained by a water course from the lowest part of the workings.

The company work 149 convicts in the mine.

The following order was issued;

COAL CREEK, October 15, 1885.

To Capt. John Chumbley, Superintendent for Knoxville Iron Company at Coal Creek, Tenn.:

As Inspector of Mines I have fully examined the mines operated by the Knoxville Iron Company, situated at this place.

I find the mines in first rate condition, with the following exception :

The locomotive for drawing out the loaded cars enters some distance into the mouth of the mine, and as this opening is the intake for the air which passes around the face of the mine, as a natural consequence the smoke from this engine passes around with the air.

As the breathing of air vitiated with smoke is injurious to the health of men working in the mine, I, the Inspector of Mines, hereby specify :

That within the space of one month from date the defect be remedied, and that the smoke of the locomotive be no longer allowed to enter further into the mine than the engine itself, and that the smoke be removed as rapidly as possible. Respectfully,

Jo. C. GUILD, Inspector of Mines.

COAL CREEK CONSOLIDATED MINING CO.

OFFICERS OF THE COMPANY.

T. H. HEALD, President, Knoxville.

E. C. LOCKE, Secretary and Treasurer, Knoxville.

J. M. ANDREWS, Superintendent, Coal Creek.

This company are the land owners at this point and lease to the other companies operating here. They are now themselves operating two mines, the Black Diamond and Empire.

BLACK DIAMOND MINE.

Inspected October 14, 1885; barometer, 29.25; temperature, 58° F.

G. W. Bennett, Assistant Superintendent at Black Diamond.

This is an old mine, and a great deal of work has been done. The pillars are now being drawn, preparatory to deserting the mine.

The principal work now being carried on is in an entry on the left of the main entry, known as the Shelby entry, and a short entry on the right of the main entry.

This mine has five openings to light and no artificial means are used to ventilate it.

An insufficient supply of air was circulating in the Shelby entry and in the head of the main entry, which the Superintendent will remedy at once.

The ventilation of the entry on the right of the main entry is good. One hundred and twenty miners are at work in this mine.

THE EMPIRE MINE.

Inspected October 14, 1885; barometer, 29.25, temperature, 58° F.

Wm. Jones, Assistant Superintendent at Empire.

The main entry of this mine passes for a long distance through old works, and at the present time only two entries on the right of the main entry are being worked, one of which is eighty yards and the other fifty yards long.

The air passes in on the main entry and is turned upon the cross-entries, and after passing through them passes back

through an air course parallel to the main entry and off to an upcast shaft and furnace some distance away. The part of this upcast above ground was of wood and burned down a few days ago, which has interfered somewhat with the ventilation of the mine.

A new upcast has been opened in a more desirable place than the old one, and as soon as the furnace can be constructed and the air courses connected this will be used to ventilate the mine. The new upcast is 5x6 and 50 feet high.

The air measured on the return air course to the upcast showed a velocity of 128 feet and 2,880 cubic feet of air per minute.

All of this air does not pass around the face of the works on account of leaks in the brattices, which were ordered stopped. Thirty-eight miners work in the mine.

COAL CREEK COAL COMPANY.

[*Fraterville Mine.*]

OFFICERS OF THE COMPANY.

H. N. CAMP, Manager, Knoxville, Tenn.

CHAS. McKARSIE, Superintendent, Coal Creek, Tenn.

DAVID JONES, Mine Superintendent.

This company are lessees from the Coal Creek Consolidated Mining Company, and have been mining here for eighteen years.

There is 1,500 yards of entry, and the output is 250 tons of coal per day.

Mine inspected October 14; barometer, 29.25; temperature, 58° F.

The mine now has a main entry and four cross-entries, two on either side of the main entry. Another entry, known as the Monkey entry, is driven in the side of the hill and intersects the first cross-entry on the left of the main entry. Another cross-entry is driven from the Monkey entry parallel to No. 1 on the left.

The ventilation of the mine is effected by an upcast shaft twenty-five feet high, with furnace near the mouth of the main entry.

The measurement of air passing in on the Monkey entry shows a velocity of 140 feet and 6,300 cubic feet of air per minute; 2,860 cubic feet of air pass in and around the face of the cross-entries on the right and left of main entry.

The velocity of the air at the upcast was 418 feet per minute, and furnished 10,082 cubic feet.

The air in the face of cross-entry No. 1, on left of the main entry, and in the face of the entry from Monkey parallel to it, is somewhat dull. This is caused by delay in making a cross-cut between these two entries, which will be done immediately. Eighty miners are employed in this mine.

NEW RIVER COAL COMPANY.

OFFICERS OF THE COMPANY.

T. H. HEALD, Receiver, Knoxville, Tenn.

JOHN M. BROOKS, General Manager.

HECTOR COFFIN, Secretary and Treasurer.

This company are lessees from the Coal Creek Consolidated Mining Company, and their mine is located three and one-half miles from Coal Creek, and reached by a branch road from the Knoxville & Ohio Division of the East Tennessee, Virginia & Georgia Railroad.

Mine inspected October 15, 1885.

In this mine is a main entry and six cross-entries.

The ventilation is effected by an upcast shaft fifty feet high, and a furnace.

The main entry is the intake for the air, and the velocity here was 228 feet, and 5,700 cubic feet per minute passes.

The return air measured on cross entry No. 1, on the right of main entry, on its way to the upcast, was moving with a velocity of 118 feet per minute, and furnished 5,310 cubic feet of air per minute.

The air in the two cross-entries on the left of the main entry and in one on the right and in the face of the main entry is bad and close, very little air moving. This is for two reasons :

1. The ventilation furnished is too small for the duty required of it.

2. On account of neglect to put up and keep in good order the brattices in the mine.

I, as Inspector of Mines, left orders here that no men be allowed to work in the entries in which air was bad, except enough to improve the ventilation of said entries.

The company will, before any extensive work is done, construct a new ventilating furnace. Eighty men are employed in this mine.

H. B. & JOEL BOWLING MINE.

This is only a small mine, leased from the Coal Creek Consolidated Mining Company, and situated three and one-half miles from Coal Creek, near the mine of the New River Coal Company.

It is worked by the Messrs. Bowling, who get out about three carloads of coal per day.

Mine inspected October 15, 1885.

The mine has several openings, and only natural ventilation is used to supply the mine with air.

The drainage of the mine is very poor, but this is being improved.

When the mine assumes greater proportions artificial means will have to be resorted to to procure good ventilation.

Respectfully submitted,

JO. C. GUILD, Inspector of Mines.

AN ACT

To provide for the ventilation of mines and collieries, and the protection of human life therein, of the State of Tennessee.

SECTION 1. *Be it enacted by the General Assembly of the State of Tennessee*, That the owners, agent, or agents of every coal mine or colliery shall make, or cause to be made, an accurate map or plan of the workings of such coal mine or colliery, on a scale of not more than one hundred feet to the inch, which map or plan shall exhibit the workings in each seam of coal, and shall state the general inclination of the strata, with any material deflections therein in said workings, and shall truthfully and accurately show the boundary lines of the lands of the said coal mines or colliery, and the proximity of the workings to the lines of adjacent owners, a true copy of which map or plan the said owners, agent, or agents shall deposit with the inspector of coal mines or collieries for the district in which the coal mine or colliery is situated, within four months from the passage of this act, and one copy shall be kept at the office of each colliery, and the said owners, agent, or agents shall furnish to the inspector aforesaid, on the 1st day of January and July in every year hereafter, a statement, or map, or plan of the progress of the workings of such coal mine or colliery during

the six months past, up to date, to enable the inspector to mark the same upon the map (or plan of the map) or plan of the coal mine or colliery furnished and deposited with said inspector, as hereinbefore provided for, and when any coal mine or colliery is worked out preparatory to being abandoned, or when any local lift thereof is being finished, with a view and for the purpose of being abandoned, the owners, agent, or agents of such mine or colliery shall have the map or plan thereof furnished as hereinbefore provided, or such portions thereof as the case may require, carefully verified; and notice shall be given to the inspector of coal mines or collieries for the district, in writing, of the purpose to abandon; and in the case the said owners, agent, or agents shall neglect or refuse to furnish the maps or plans by this section required, or any of them, or shall knowingly or designedly cause such maps or plans, when furnished, to be incorrect or false, such owners, agent or agents thus offending, shall be guilty of a misdemeanor, and, upon conviction, shall be punished by a fine not less than fifty nor more than five hundred dollars, or imprisoned not exceeding three months, at the discretion of the court.

SEC. 2. *Be it further enacted*, That whenever the owners, agent, or agents of any coal mine or colliery shall neglect or refuse, or from any cause fail, for the period of two months, to furnish to the inspector the map or plan of the addition thereto, provided for in the first section of this act; or if the inspector finds, or has reason to believe, that any plan or map of any coal mine or colliery furnished him under the provisions of this act is materially inaccurate or imperfect, he is hereby authorized to cause an accurate map or plan of the actual workings of such coal mine or colliery to be made at the expense of the owner or owners thereof, the cost of which shall be recoverable by law, as other debts are from said owner or owners.

SEC. 3. *Be it further enacted*, That four months from and after the passage of this act it shall not be lawful for the owners, agent, or agents of any coal mine or colliery, worked by or through a shaft or slope, to employ any person or persons in working with such coal mine or colliery, or to permit any person to be in such coal mine or colliery for the purpose of working

therein unless there are, in communication with every seam or stratum of coal worked in such coal mine or colliery, for the time being at work, at least two shafts, or slopes, or outlets, separated by natural strata of not less than 150 feet in breadth, by which shafts, slopes or outlets, distinct means of ingress and egress are always available for the person or persons so employed in the coal mine or colliery; but it shall not be necessary for the two shafts, slopes, or outlets to belong to the same coal mine or colliery if the person or persons therein employed have ready and available means of ingress and egress, by not less than two shafts, slopes, or outlets, one or more of which may belong to another coal mine or colliery; *provided*, that second opening can be had through coal, but that if any tunnel or shaft will be required for the additional opening, work upon the same to commence immediately after the passage of this act, and continue until its final completion, with not less than three shifts in each twenty-four hours, and as many hands to be employed as can be put to work to advantage, the inspector to be the judge as to the least number of hands engaged per shift. This section shall not apply to opening a new coal mine or colliery, nor to any working for the purpose of making a communication between two or more shafts, slopes or outlets, so long as not more than twenty persons are employed at any one time in said new mine or working. And the term "owner," used in this act, shall mean the immediate proprietor, lessee, or occupier of a coal mine or colliery, or of any part thereof, and the term "agent" shall mean any person having, on behalf of the owner, the care or direction of a coal mine or colliery, or any part thereof.

SEC. 4. *Be it further enacted*, That any of the courts of law or equity of this State having jurisdiction where the coal mine or colliery proceeded against is situated, upon application of the inspector of coal mines and collieries of the proper district, acting in behalf of the State of Tennessee, shall prohibit, by injunction or otherwise, the working of any mine in which any person or persons are employed in working, or are permitted to be for the purpose of working, in contravention of the provisions of this act, and may award such costs in the matter of the injunction or other proceedings as the court may think just;



GOLD BASIS (4088).

Property of THOS. H. MALONE, Nashville, Tenn.

but this section shall be without prejudice to any other remedy permitted by law for enforcing the provisions of this act.

SEC. 6. *Be it further enacted*, That the owner, lessee, operator or agent of every coal mine or colliery shall erect or provide at or near the mouth or entrance to such mine, and maintain the same at all times, a suitable tank or tanks filled with water, where men are employed in such mines, to wash and change their clothes when entering the mine and when returning therefrom.

SEC. 7. *Be it further enacted*, That the owners or agents of every coal mine or colliery shall provide and establish for every such coal mine or colliery an adequate amount of ventilation, and not less than fifty-five cubic feet per second of pure air, or 3,300 cubic feet per minute for every fifty men at work in such mine, and as much more as circumstances may require, which will be circulated through to the face of each and every working-place throughout the entire mine, to dilute and render harmless, and expel therefrom the noxious, poisonous gases to such an extent that the entire mine shall be in a fit state for men to work therein, and be free from danger to the health and lives of the men by reason of said noxious and poisonous gases, and all workings shall be kept clear of standing gases. The ventilation may be produced by blowing engines, air-pumps, forcing or suction fans of sufficient capacity or power, or such other suitable appliances as to produce and insure constantly an abundant supply of fresh air throughout the entire mine; but in no case shall a furnace be used inside of the mine where the coal breaker and chute buildings are built directly over and covering the top of the shaft for the purpose of producing a hot upcast of air; and there shall be an intake airway of not less than twenty square feet area, and the return airway shall not be less than twenty-five square feet.

SEC. 8. *Be it further enacted*, That to better secure the ventilation of every coal mine and colliery, and provide for the health and safety of the men employed therein, otherwise and in every respect the owner or agent, as the case may be, in charge of every coal mine or colliery, shall employ a competent and practical inside overseer, to be called "mining boss," who shall keep

a careful watch over the ventilating apparatus, over the air-ways, the traveling-ways, the pump and sumps and timbering; to see, as the miners advance in their excavations, that all loose coal, slate or rock overhead is carefully secured against falling; over the arrangements for signaling from the bottom to the top, and from the top to the bottom of the shaft or slope; over the metal tubes from the top to the bottom of the shaft or slope for the purpose of talking through, and all things connected with and appertaining to the safety of the men at work in the mine. He or his assistants shall examine carefully the workings of all mines generating explosive gases every morning before the miners enter the coal mine or colliery, and shall ascertain that the mine is free from danger; and the workmen shall not enter the mine until such examination shall have been made and reported, and the cause of danger, if any exists, be removed; and he or his assistant shall also, every evening, when the workmen leave the mine or colliery, go over the mine and see that the doors of the passage-ways are all properly closed, and that all the air-ways are free and unobstructed to the passage of air through them. It shall be the duty of the mine boss to measure the ventilation at least once a week at the inlet and outlet; also at or near the face of all gang-ways, and all measurements to be reported to the inspector once per month.

SEC. 9. *Be it further enacted,* That all and every of the safety-lamps used in said coal mines or collieries shall be the property of the possessor thereof, and be under the charge of a suitable person under the direction of the mining boss, who shall keep them clean and in good order; and the mining boss shall provide that all doors used in assisting or in any way affecting the ventilation of the mine, shall be so hung and adjusted as that they will close of their own accord, and cannot stand open, and the main air-doors on the traveling roads shall be double, and an extra door shall be filed, to be closed only in the event of an accident to one of the others, and the sides and top of such doors shall be well built with stone or mortar in mines in which the inspector shall deem it necessary and shall order, and all main doors shall be provided with an attendant, whose constant duty it shall be to guard them and prevent them being left open; and every mine having explosive gas in each and every

part of such mine or mines shall be divided into two, four, or more panels or districts, each ventilated by a separate split or current of air, and fifty persons shall be the greatest number that shall work in any one panel or district at the same time, and bore-holes shall be kept twenty feet in advance of the face of each and every place, and if necessary, on both sides, when the same is driven toward or approaching an abandoned mine or part of mine, suspected to contain inflammable gases, or which is inundated with water.

SEC. 10. *Be it further enacted*, That the owner or agents of every coal mine or colliery opened and operated by shafts or slopes shall provide and maintain a metal tube from top to bottom of such slope or shaft, suitably calculated and adapted to the free passage of sound therein, through which conversation may be held by and between persons at the bottom and at the top of the shaft or slope, and also some modern practical means for signaling from and to the top of the shaft from the bottom of said shaft or slope, and also provide an improved safety-catch, and a sufficient cover overhead on every carriage used for lowering or hoisting persons, and they shall provide and arrange the flanges or horns of sufficient dimensions, one attached to the sides of the drum of every machine that is used for lowering or hoisting persons in or out of any mine, and adequate brake shall be attached to every drum or machine, worked by steam or water power, that is or will be used for lowering or raising into or out of any of said mines, and the main link attached to the swivel of the wire or any other rope shall be made of the best quality of iron, and tested by weights or otherwise, of one-third greater power or strain than is likely to ever be placed on said link or swivel while in use at said coal mine or colliery for lowering or raising purposes. Said test shall be entirely satisfactory to the inspector, and bridle-chains shall be attached to the main link from the cross-pieces of the carriage, and no single link-chain shall be used for lowering or raising persons into or out of any of said mines, and no boy under twelve years of age shall work or enter any mine, and proof must be given of his age, by certificate or otherwise, before he shall be employed, and no father or other person shall conceal or misrepresent the age of any boy knowingly. The

neglect or refusal of any person or parties to perform the duties provided for and required to be performed by sections 6, 7, 8, 9 and 10 of this act by the parties therein required to perform them, shall be taken and be deemed a misdemeanor by them, or either of them, and upon conviction thereof, they, or any of them, shall be punished by imprisonment and fine, or either, at the discretion of the court trying the same.

SEC. 11. *Be it further enacted,* That no owner or agents of or at any coal mine or colliery operated by shaft or slope shall place in charge of any engine whereby the men are lowered into or hoisted out of the mine any but experienced, competent, sober engineers; shall constantly attend to the engine of which he has charge, and shall not allow any person, except such as may be deputized by the operator or agents, to touch or meddle with any part of the machinery. He shall work his engine slowly and with great care when any person or persons are ascending or descending the slopes, and when any person is about to descend or ascend the shaft or slope, the men at the bottom or top, as the case may be, must inform the engineer, by the metal tube, the signal or otherwise, thereof; and no one shall interfere with or in any way intimidate the engineer in the discharge of his duties, nor ride upon a loaded wagon or cage in any shaft or slope, and in no case shall more than ten men ride on any wagon or cage at one time in any of the said mines; and upon any person violating the provisions of this section, he shall be held and deemed guilty of a misdemeanor, and upon conviction thereof, he shall be punished by fine and imprisonment, at the discretion of the court trying the same.

SEC. 12. *Be it further enacted,* That whenever loss of life or serious personal injuries to any person shall occur by reason of any explosion or other accident, in or about any mine or colliery, it shall be the duty of any party having charge of such coal mine or colliery to give notice thereof forthwith, by mail or otherwise, to the inspector of coal mines and collieries for the district, and to the coroner of the county if any person is killed thereby, and due notice shall be given by the coroner of any inquest to be held as the result of any such explosion or acci-

dent; and it shall be the duty of the said inspector to immediately repair to the scene of the accident, and make such suggestions as may appear necessary to secure the safety of the men; and if the result of the explosion does not require an investigation by the coroner, he shall investigate into and ascertain the cause of the explosion or accident, and make a record thereof, which he shall preserve with the records of his office; and to enable him to make the investigation, he shall have power upon such occasions to compel the attendance of persons to testify, and to administer oaths or affirmations thereto, the costs of which investigation shall be paid by the county in which the accident occurred, in the same manner as costs of inquests held by the coroner or justices of the peace are now paid; and the failure of the person in charge of the coal mine or colliery to give notice to the inspector and coroner as provided for in this section, shall subject him or them to a fine of not less than twenty-five dollars nor more than one hundred dollars, to be recovered as other fines are to the county treasury, for the use of the public schools of the county in which the person or persons may be convicted.

Sec. 18. *Be it further enacted,* That all boilers used for generating steam in and about coal mines or collieries shall be kept in good order, and the owner or agent thereof shall have them examined and inspected by a competent board of boiler inspectors, as provided for in the case of steam navigation, railroads, etc., as often as once every six months, and oftener if needed, and the result of such examination, under oath, shall be certified in writing to the inspector for the district; and all machinery in and about the mines, and especially in the coal-breakers, where boys work, shall be properly fenced off, and the top of such shaft shall be securely fenced off by vertical or flat gates covering the area of said shaft, and the entrance of every abandoned slope and other air shafts shall be securely fenced off.

Sec. 14. *Be it further enacted,* That the duties of inspector, herein specified, shall be fulfilled by the geologist of the Bureau of Agriculture, Statistics and Mines, with power to employ such assistants as may be absolutely necessary.

SEC. 15. *Be it further enacted*, That said geologist in the employ of the Bureau of Agriculture, Statistics and Mines shall receive for his services as inspector of mines an annual salary of six hundred dollars and traveling expenses, and office rent and assistant, and such further sum as may be necessary, but in no case to exceed a total of all expense per annum of one thousand dollars, exclusive of the salary of inspector.

SEC. 16. *Be it further enacted*, That the salary of said inspector, together with his expenses in carrying out the provisions of this act, shall be paid by the State Treasurer upon accounts presented, with vouchers attached and approved by the Governor.

SEC. 17. *Be it further enacted*, That the said inspector shall have his office in the city of Chattanooga, in this State, where shall be kept a copy of the maps and plans of all the coal mines in this State that are operated, or being operated, and the records thereof, together with all the papers relative thereto, as provided for in this act.

SEC. 18. *Be it further enacted*, That it shall be the duty of the said inspector to examine all the coal mines or collieries in this State at least once in every six months, or more often if he deem necessary ; and also attend all inquests held by the coroner or coroners upon the bodies of persons killed in or about the coal mines or collieries of this State.

SEC. 19. *Be it further enacted*, That any miner, workman, or any other person who shall knowingly injure any safety-lamp, water-gauge, barometer, air course, brattice, or obstruct or throw open air-ways, or carry lighted pipes or matches into places that are worked by safety-lamps, or handle or disturb any part of the machinery of the hoisting engine or engines, or open the door and not have the same closed, whereby danger is caused in the mine, or enter any place of the mine against caution, or disobey any order given in carrying out the provisions of this act, or shall ride upon a loaded car or carriage in any shaft or slope, or on any plane in or around any of said

mines, or do any act whereby the lives or the health of persons, or the security of the mines or the machinery, is endangered, or any miner having charge of a working-place in any coal mine or colliery who shall neglect or refuse to keep the roof thereof properly propped and timbered to prevent the falling of coal, slate or rocks, every such person or persons shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by imprisonment and fine, at the discretion of the court trying the case.

SEC. 20. *Be it further enacted*, That it shall be lawful for any inspector to enter, inspect, and examine any coal mine or colliery of his district, and the works and machinery belonging thereto, at all reasonable times, by night or day, but so as not to impede or obstruct the working of the coal mine or colliery, and to make inquiry into and touching the state and condition of such coal mine or colliery, works and machinery, and the mode of lighting and using lights in the same, and into all matters and things connected with or relating to the safety of the persons employed in or about the same, and especially to make inquiry whether the provisions of this act are complied with in relation to such; and the owner or owners, agent or agents of such coal mine or colliery is hereby required to furnish the means necessary for such entry, inspection, examination, and inquiry, of which the said inspector shall make entry in the record of his office, noting the time and material circumstances of inspection.

SEC. 23. *Be it further enacted*, That the said inspector shall be an expert in the principles of mining and the opening and making of coal mines, and shall have had practical experience therein.

SEC. 24. *Be it further enacted*, That the inspector of mines and collieries, before entering upon the duties of his office as such, shall take an oath or affirmation before any Circuit Court Clerk within this State, for the faithful and impartial performance of the same, which oath or affirmation shall be filed in the office

of the Circuit Court Clerk administering the same, and such inspector shall provide himself with the most approved modern instruments and chemical tests for carrying out the intentions of this act.

Passed April 7, 1881.

H. B. RAMSEY,
Speaker of the House of Representatives.

GEO. H. MORGAN,
Speaker of the Senate.

Approved April 7, 1881.

ALVIN HAWKINS,
Governor.

SECOND SEMI-ANNUAL REPORT.

JUNE 1, 1886.

HON. A. J. McWHIRTER, *Commissioner of Agriculture, Statistics,
Mines and Immigration:*

SIR—Pursuant to an act of the Legislature of Tennessee, passed April 7, 1881, entitled "An act to provide for the ventilation of coal mines and collieries, and the protection of human life therein, of the State of Tennessee," I beg leave herewith to submit this, my second semi-annual report.

My first report was made in one month after my appointment, and, on account of the short time at my disposal, was of necessity brief. In this, my second report, I have endeavored to deal with every subject as its merits demand.

The managers of the different mining companies have, for the most part, shown great courtesy, and have placed at my command every means for the prosecution of my work. In some instances, however, they have refused the information necessary for the compilation of the statistics of the mining industry in this State, which I could not insist upon, as they are not by law required to furnish such information.

Respectfully,

JO. C. GUILD,

Inspector of Mines.

I.—THE MINES OF TENNESSEE.

There are now twenty companies engaged in mining coal in the State of Tennessee, and thirty-four separate mines owned or operated by these companies, and subject to inspection.

For convenience and not from any similarity of geological formation—for in the same division occur coals entirely different—I will divide the coal field of Tennessee into three divisions, according to the railroads over which their products are transported.

District I. includes those mines near the Nashville, Chattanooga & St. Louis Railway, namely, the Tennessee Coal, Iron & Railroad Company and the Etna Coal Company.

District II. includes those on or near the line of the Cincinnati Southern Railroad, namely, the Tabler-Crudup Coal and Coke Company, the Soddy Coal Company, Walden Ridge Mining Company, Dayton Coal and Iron Company, Roane Iron Company, Poplar Creek Coal Company, Mount Carbon Coal Company, Winter's Gap Coal Company, Eureka Coal Company, Oliver Coal Company, and Glen Mary Coal and Coke Company.

District III. includes the mines situated on the Knoxville & Ohio Division of the East Tennessee, Virginia & Georgia Railroad, namely, the Standard Coal and Coke Company, Jellico Mountain Coal and Coke Company, Knoxville Iron Company, Coal Creek Consolidated Mining Company, Coal Creek Coal Company, New River Coal Company and Heck & Petree.

Table of Mines Being Operated in Tennessee.

	COMPANY.	MINE.	POST-OFFICE.	COUNTY.	RAILROAD.	No. MINES	HOW VENTILATED.
I	1 Tenn. Coal, Iron & Rail'd	Number 1.---	Tracy City---	Grundy---	T. C., I. & R. R. Co.'s Road.	73	Natural.
2	" "	Number 2.---	"	"	"	35	Furnace.
3	" "	Number 3.---	"	"	"	10	Natural.
4	" "	Bats' Nest.---	"	"	"	12	Natural.
5	" "	Rattlesnake---	"	"	"	40	Furnace.
6	" "	Lone Rock.---	"	"	"	195*	Furnace.
7	" "	East Fork.---	"	"	"	38	Natural.
8	" "	Petersburg.---	"	"	"	23	Natural.
9	" "	John'n Entry---	"	"	"	20	Natural.
10	Etna Coal & Coke	Etna.---	Whiteside---	Marion---	Nashville & Chattanooga.	68	Furnace.
11	Tabl'r-Crudup Coal & Coke	Number 1.---	Daisy---	Hamilton---	Cin. Southern---	20	Natural, with shaft.
12	Soddy Coal.---	Number 1.---	Soddy---	"	"	325	Furnace.
13	"	Number 2.---	"	"	"		
14	"	Number 3.---	"	"	"		
15	"	Number 4.---	"	"	"		
16	Walden Ridge Iron	Number 1.---	Sale Creek---	"	"	45	Furnace.
17	Dayton Coal & Iron	Number 1.---	Dayton---	Rhea.---	"		
18	"	Number 2.---	"	"	"	160	Natural, with shaft.
19	"	Number 3.---	"	"	"		
20	Roane Iron	One Mine.---	Rockwood---	Roane.---	"	100	Natural.
21	Poplar Creek Coal	"	Olivers---	Anderson.---	Walnut Ridge	30	"
22	Mount Carbon Coal	"	"	"	"	25	Closed
23	Winter's Gap Coal	"	"	"	"		
24	Eureka Coal	"	"	"	"	200	Natural.
25	Oliver Coal	"	"	"	"		
26	Glen Mary Coal & Coke	"	Glen Mary---	Scott---	Cin. Southern---	200	Natural.
II							

27	Standard Coal & Coke	One Mine.	Newcomb.	Campbell	K. & O.	Div. E. T.	V. & G.	175	Furnace.
28	Jellico M'n'n Coal & Coke	"	"	"	"	"	"	180	Furnace.
29	Knoxville Iron Company	"	Coal Creek	Anderson.	"	"	"	125*	Furnace.
30	Coal Creek Consolid'd Iron	Bl'ck Diam'd	"	"	"	"	"	Closed	Natural.
31	"	Empire.	"	"	"	"	"	75	Furnace.
32	Coal Creek Coal.	Fraterville.	"	"	"	"	"	80	Furnace.
33	New River Coal.	Bet'r Chance.	"	"	"	"	"	25	Furnace.
34	Heck & Petree.	Bowling.	"	"	"	"	"	11	Natural.

*Convicts.

III

Twenty-two hundred miners alone, and about 3,500 persons altogether, are given employment directly by the mining industry of the State of Tennessee. As near as can be estimated, between 12,000 and 15,000 persons owe their daily bread to this industry.

The distribution of mines by counties is shown by the following table :

DISTRIBUTION OF MINES BY COUNTIES.

Dist.	COUNTIES.	COUNTY SEAT.	No. of Companies.	No. of Openings.
I. {	Grundy-----	Altamont-----	1	9
	Marion-----	Jasper-----	1	1
	Hamilton-----	Chattanooga-----	3	6
II. {	Rhea-----	Washington-----	1	3
	Roane-----	Kingston-----	1	1
	Anderson-----	Clinton-----	5	5
III. {	Scott-----	Huntsville-----	1	1
	Campbell-----	Jacksboro-----	2	2
	Anderson-----	Clinton-----	5	6
	Total-----	-----	20	34

MINES IN DETAIL.

DISTRICT I.

TENNESSEE COAL, IRON AND RAILROAD COMPANY

NAT. BAXTER, President, Nashville.

J. BOWRON, Manager, Nashville.

E. O. NATHURST, Superintendent, Tracy City.

F. P. CLUTE, Resident Engineer, Tracy City.

The mines of this company were first opened in 1852, by a company under the name of the Sewanee Mining Company, who commenced the construction of a railroad from the Nashville & Chattanooga Railroad at Cowan, to the mines, a distance of twenty miles, in the year 1854, which was finished in 1859.

In 1860, the Tennessee Coal and Railroad Company, with Hon. A. S. Colyar as President, began operations.

In 1862, the mines were abandoned by the company, but were worked from then until the close of the war by the United States, for the benefit of the army.

The first coke was shipped in 1868, but not until 1873 was the manufacture of coke begun on a large scale.

In 1880 the erection of a blast furnace at Cowan was begun, and it was finished in 1881.

In the early part of 1882, the property was sold to parties who changed the name to the Tennessee Coal, Iron and Railroad Company.

The company is now, in addition to the stack at Cowan, operating two blast furnaces at South Pittsburg, in the Sequatchie Valley, and devotes most of the coal mined to the manufacture of coke to supply these furnaces with fuel.

This company is now working nine mines, in which are employed about five hundred miners, two hundred of whom are convicts.

The coke plants consist of five hundred and forty coke ovens, which, with the exception of six, are the ordinary "beehive" oven. The six referred to have been especially designed by Mr. F. P. Clute, the resident engineer, and promise to be a great improvement on the old-style oven. It is thought that not only will much time be saved, but a better coke made by this improved oven. A test of the utility of this oven is now being made, and should the test prove satisfactory, I will endeavor, in my next report, to publish the result.

PRODUCTION OF COAL AND COKE.

<i>Years.</i>	<i>Coal (tons.)</i>	<i>Coke (tons.)</i>
1873.....	99,380	1,243
1877.....	103,951	21,060
1882.....	144,689	108,158
1885.....	181,081	107,958

The output by months for 1886, from January to May, was :

<i>Months.</i>	<i>Coal (tons.)</i>	<i>Coke (tons.)</i>
January	9,705	10,887
February.....	10,587	18,046
March	12,209	10,106
April.....	11,126	8,579
Totals	43,627	42,618

ETNA COAL COMPANY.

DR. WM. MORROW, President, Nashville, Tenn.

D. B. PILLSBURY, General Manager, Whiteside.

J. T. HILL, Secretary, Chattanooga.

The mines, situated near Whiteside, Marion County, were first opened in 1882, by an Eastern company, and since that time have been operated by several companies with varying success. The present company was organized in August, 1881, under the name of the Etna Coal Company.

The coal mined by this company is justly celebrated as a fine blacksmith coal, and is one of the finest coals known for this purpose; the coke produced from it is also celebrated as a foundry coke of unsurpassed quality.

The company employs 68 miners, and has in all about 100 employes.

The price per ton paid for mining coal is 70 cents, and the total amount of wages paid from July 1, 1885, to March 31, 1886, was \$40,169.60.

In the year 1882, 22,730 tons of coal, and 7,609 tons of coke were produced.

From July 1, 1885, to March 31, 1886, 665,359 bushels or 26,614 tons of coal, and 336,689 bushels of coke were produced.

The mines are well ventilated by a shaft and furnace near the face of the main entry.

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DISTRICT II.

TABLER-CRUDUP COAL AND COKE COMPANY.

J. H. TABLER, President, Chattanooga.

THOS. PARKES, Vice-President and Secretary, Daisy.

D. G. CRUDUP, Treasurer, Chattanooga.

The mine operated by this company is situated on the line of the Cincinnati Southern Railroad, eighteen miles north of Chattanooga.

This company has built twenty-five coke ovens, and has nearly completed fifty others. Very little work has been done lately within the mines, but extensive preparations have been made to mine on a large scale.

The mine as to ventilation is in very good condition, only some of the doors and brattices were leaky at the time of the inspection, which defect was remedied. Some water had collected in the face of the main entry, but a pump has been put to work to clear this.

SODDY COAL COMPANY.

M. H. CLIFF, President, Chattanooga.

J. T. WILLIAMS, General Manager, Chattanooga.

J. W. CLIFF, Secretary, Soddy.

M. L. JENKINS, Superintendent, Soddy.

The post-office address of the company is Soddy, Hamilton County.

The mines are situated near the line of the Cincinnati Southern Railroad, at Rathburn, twenty-one miles from Chattanooga.

The mines of this company were opened in 1867, by an association of Welshmen, on the co-operative plan.

The present company took charge in 1877.

The mines are reached by a narrow-gauge railroad, extending from the Tennessee River, on one side of the Cincinnati Southern Railroad, to the mines on the other side.

There are four mines, Nos. 1, 2, 3 and 4, of which Nos. 1, 3 and 4 only are now being worked.

This company employs 325 miners; the total number of employees being 425.

The miners receive 65 cents per ton for 28-inch coal; 60 cents per ton for 30-inch coal, and 55 cents per ton for 36-inch coal and over.

From March 1, 1885, to March 1, 1886, \$69,762.95 was paid by the company for mining coal alone. During this time 2,688,346 bushels of coal were mined, and 1,535,438 bushels of coke made. There have been, until lately, one hundred and fifty coke ovens, but very lately the number has been increased to such an extent as to double the output.

Mines Nos. 1, 2 and 3 are ventilated by a single furnace and upcast shaft, and No. 4 by a separate furnace.

Work will be commenced immediately to build a separate furnace for the ventilation of No. 3.

WALDEN RIDGE MINING COMPANY.

W. R. LLOYD, Superintendent, Sale Creek.

The stockholders and officers of this company are the same as the Soddy Coal Company.

The mine is near Rock Creek Station, on the Cincinnati Southern Railroad, thirty miles from Chattanooga, and sixty miners are employed in the mine.

DAYTON COAL AND IRON COMPANY. (Limited.)

This company is composed of an English syndicate, which, in addition to the mines and coke ovens on Richland Creek, two and one-half miles from Dayton, also has a very fine plant for the manufacture of iron at Dayton, consisting of two stacks, with a daily capacity of 110 tons of pig metal. The output of the mines is entirely used for the manufacture of coke as fuel for these furnaces.

The company operates three mines, Nos. 1, 2 and 3, and employs 160 miners.

Average output of mines, 250 tons of coal per day; average output of coke 150 tons per day.

The wages paid for mining coal are 60 cents to \$1.00 per ton, according to thickness.

ROANE IRON COMPANY.

H. S. CHAMBERLAIN, President, Chattanooga.

H. CLAY EVANS, Secretary, Chattanooga.

M. M. DUNCAN, Superintendent, Rockwood.

The mines of the Roane Iron Company are situated on a broad-gauge spur track, connecting with the Cincinnati Southern Railroad at Rockwood, seventy miles north of Chattanooga.

The company has an iron plant consisting of two stacks, with a capacity of ninety tons per day. Almost the entire output of the mines is manufactured into coke, by 180 coke ovens, as fuel for these furnaces.

Three hundred miners are employed, and $37\frac{1}{2}$ cents per ton paid for mining coal.

Average monthly output of coal, 240,000 bushels, or about 9,600 tons, all of which is manufactured into coke.

POPLAR CREEK COAL COMPANY.

W. S. GEERS, Superintendent, Olivers.

The mine of this company is near Oliver Springs, Anderson County, on the Walden Ridge Railroad, nineteen miles from Knoxville Junction, on the Cincinnati Southern Railroad, which is seventy-nine miles north of Chattanooga.

The number of miners employed is about thirty, and the average output of coal per month, 22,660 bushels. Wages paid for mining coal, from 50 cents to 75 cents per ton.

WINTER'S GAP COAL COMPANY.

T. PHILLIPS, President, Olivers.

M. LLEWELLYN, Secretary and Treasurer, Olivers.

The mine of this company is also at Oliver Springs. Twenty miners are employed, and five outside hands. Average output of coal, 20,000 bushels per month.

Wages paid for mining coal, 75 cents per ton, and outside hands \$1.25 per day.

At this place are also the

Mt. Carbon Coal Company, W. B. H. Wiley, Superintendent;
Eureka Coal Company, Thomas Jenkins, Superintendent, and
Oliver Coal Company, Jos. Richards, Superintendent.

At these three mines very little work is being done, principally, I believe, on account of inadequate transportation and high freights.

GLEN MARY COAL AND COKE COMPANY.

GEO. W. DARNALL, President and Treasurer, Lexington, Ky.
J. P. SHAW, Lexington, Ky.
JNO. H. CLARKE, Manager, Glen Mary, Tenn.

The mine is near Glen Mary, Scott County, on the Cincinnati Southern Railroad, 112 miles from Chattanooga.

About 200 men are employed under ground, and only natural means are used for the ventilation of the mine.

DISTRICT III.

STANDARD COAL AND COKE COMPANY.

W. W. WOODRUFF, President, Knoxville.

E. E. McCROSKY, Secretary and Treasurer, Knoxville.

J. F. McCLURE, Vice-President and General Manager, Newcomb.

The mine of the company is situated on a broad-gauge spur track, one mile in length, connecting with the Knoxville and Ohio division of the East Tennessee, Virginia & Georgia Railroad, at Newcomb Station.

The company first opened the mine in September, 1883, and shipped the first load of coal January 19, 1884.

From April 1, 1885, to March 31, 1886, the shipments of coal amounted to 61,796 tons.

About 175 miners are employed, and 75 cents per ton is paid for mining coal. Previously it had been the custom to pay 56½ cents per ton from April to October, and 75 cents per ton from October to April, but in April last the men went out on a strike at the reduction to summer prices, but after twenty-two days returned at a rate of 75 cents the year round.

A new upcast shaft has been sunk and furnace built, which greatly improves the ventilation of the mine.

KNOXVILLE IRON COMPANY.

W. R. TUTTLE, President, Knoxville.

W. S. MEAD, Secretary, Knoxville.

JOHN CHUMBLEY, Superintendent, Coal Creek.

J. E. HIGHTOWER, Mine Superintendent, Coal Creek.

The mine is about one mile from Coal Creek, on a broad-gauge spur track, connecting with the Knoxville & Ohio Division of the East Tennessee, Virginia & Georgia Railroad.

The company holds a lease from the Coal Creek Consolidated Mining Company, and pays a royalty on all coal mined.

There are 125 miners employed in the mine, all of whom are convicts, and the average daily output amounts to 325 tons.

At the time of the first visit of the Inspector of Mines, the smoke from a locomotive was carried by the ventilating current through all portions of the mine. In order to avoid this, certain changes in the system of ventilation, suggested by the Inspector, were carried out with great success. Not only is the smoke avoided, but the ventilation of the mine is improved.

COAL CREEK CONSOLIDATED MINING COMPANY.

T. H. HEALD, President, Knoxville.

E. C. LOCKE, Secretary and Treasurer, Knoxville.

J. M. ANDREWS, Superintendent, Coal Creek.

Two mines near Coal Creek are operated by this company, the Black Diamond and the Empire, and the company also leases to the Knoxville Iron Company and the Coal Creek Mining Company.

During the floods of the past spring, a landslide occurred on the side of the mountain, above the opening of the Black Diamond mine, which closed the mouth of the main entry and covered the tramway, for one hundred yards, eight feet deep.

Seventy-five miners are employed in the Empire mine, and the output is 200 tons per day.

The ventilation is very much improved since the last visit of the Inspector, a new upcast having been sunk, and a new furnace built.

COAL CREEK MINING COMPANY.

H. N. CAMP, Manager, Knoxville.

CHARLES McKARSIE, Superintendent, Coal Creek.

DAVID JONES, Mine Superintendent, Coal Creek.

This company operates the mine known as the Fraterville mine, about two miles from Coal Creek.

The company leases from the Coal Creek Consolidated Mining Company, and the average output is about 300 tons per day. Eighty miners are employed and 62½ cents per ton paid for mining coal.

The company has been operating this mine since 1867.

NEW RIVER COAL COMPANY.

FLETCHER SMITH, Receiver, Coal Creek.

This company leases from Col. J. M. Heck, of Raleigh, North Carolina, and operates the mine known as Better Chance, located three and one-half miles from Coal Creek.

Only twenty-five miners are now employed in the mine, and the output averages 100 tons per day.

The ventilation of the mine is not good, but Mr. Smith will at once take steps to improve it.

HECK & PETREE.

These gentlemen took charge of the mine formerly operated by H. B. & Joel Bowling, on January 7, 1886. They are lessees from Col. J. M. Heck.

Only eleven miners are now employed, and the output is now about forty tons per day.

There is considerable water in the mine, but efforts are being made to improve it in this respect.

II.—STATISTICS.

Coal, within the last few years, has assumed a relation of vital importance to our social existence, and accordingly increased attention is now being directed to it.

It would seem, indeed, that the exhaustion of our coal field must inevitably be followed by the utter collapse of those industries which have made this country what it is, and that even a slight decreased production would seriously affect their position. The statistics of coal mining have become, in the past few years, of great and growing interest. The mining law of this State makes no provision for the collection of statistics, through failure to require the companies operating mines to furnish the Inspector with the requisite information as to production, etc., for the compiling of statistics. With very few exceptions, the companies show a very great reluctance to furnish this information, and it has been with great trouble the information that I am able to submit has been collected.

I cannot claim absolute accuracy for the following figures, as in many cases accurate information of the production having been refused, I have been compelled to make estimates, which are, of necessity, liable to error.

The production of coal in Tennessee is chiefly the growth of the last twenty years, and, in a great measure, of the last fifteen years. Previous to 1860, stone coal was very little used outside of Nashville and Memphis, except for blacksmith purposes, and much of that then used was brought from Pittsburg.

PRODUCTION OF COAL AND COKE FOR 1885.

<i>District.</i>	<i>Coal (tons.)</i>	<i>Coke (tons.)</i>
I.....	162,370	115,605
II.....	486,334	152,820
III.....	351,296	.....
Total.....	1,000,000	268,425

The total production of coal in this State during the year 1885, amounted to 1,000,000 tons; coke 268,425 tons, In district III. no coal is coked, all being used for domestic and manufacturing purposes. Neither is any coke made at the Poplar Creek mines, in District III., which is also all sold for domestic purposes.

The coal and iron interests of this State are intimately associated, the coal mined at many of the mines being altogether used for the manufacture of coke as fuel for blast furnaces. This branch of the industry has shown the most marked improvement.

In the year 1870, there were in the State only two companies using coke ovens, the Etna Coal Company, and the Roane Iron Company, at Rockwood, and both of these together had only thirty ovens. In 1883, there were 1,000 coke ovens in the State, showing a wonderful increase in thirteen years. At the present time there are about 1,254 ovens, which number will be considerably increased during the summer. These are distributed about as follows: Tennessee Coal, Iron and Railroad Company, 534; Etna Coal Company, 65; Tabler-Crudup Coal and Coke Company, 50; Walden Ridge Mining Company, 25; Soddy Coal Company, 175; Dayton Coal and Iron Company, 200; Roane Iron Company, 180; Glen Mary Coal and Coke Company, 25. These ovens produce 268,425 tons of coke per annum.

WAGES PAID FOR MINING COAL.

The wages paid the miners for mining coal in this State are generally fair and just, though quite a number of strikes have occurred, but these in the majority of cases have been settled by arbitration, the miners returning to work.

The price per ton differs greatly at the different mines, being fixed by the thickness of the coal and the ease with which it is mined.

Prices paid for mining coal are shown by the following:

<i>Company.</i>	<i>Price.</i>
Tennessee Coal, Iron and R. R. Co....	39 cents per ton.*
Etna Coal Company.....	70 cents per ton.
Tabler-Crudup Coal and Coke Co.....	60 cents per ton.
Soddy Coal Company.....	55 to 65 cents per ton.
Walden Ridge Mining Company.....	55 to 65 cents per ton.
Dayton Coal and Iron Company.....	60 cents to \$1 per ton.
Roane Iron Company.....	37½ cents per ton.*
Poplar Creek Coal Company.....	50 to 75 cents per ton.
Winter's Gap Coal Company.....	75 cents per ton.
Mt. Carbon Coal Company.....	50 to 75 cents per ton.
Eureka Coal Company.....	50 to 75 cents per ton.
Oliver Coal Company.....	50 to 75 cents per ton.
Glen Mary Coal Company.....	75 cents per ton.
Standard Coal Company	75 cents per ton.
Knoxville Iron Company.....	(All convicts).
Coal Creek Consolidated Mining Co.....	62½ cents per ton.
Coal Creek Mining Company.....	62½ cents per ton.
New River Coal Company.....	62½ cents per ton.
Heck & Petree.....	62½ cents per ton.

Half a million dollars is paid annually in this State to miners for mining coal alone, exclusive of all money paid for outside labor. It is impossible for me to give any reliable figures as to the amount of money put in circulation by the mining industry but the amount will, I think, exceed \$1,000,000 annually in this State.

The mines of this State employ 3,500 men altogether, of whom 2,200 are miners. About 12,000 to 15,000 persons are dependent on the mines for support. The coal miners can make from \$1.50 to \$5.00 per day, according to skill and industry. They are, as a class, prosperous and frugal.

* For run of mine.

Analyses of Tennessee Coals.

NAME OF COAL.	Fixed Carbon.	Volatile Matter.	Ash.	Sulphur.	Water.	Phosphorus.
Coal Creek-----	57.520	38.82	3.090	0.200	1.040	----
Coal Creek-----	57.690	37.80	2.550	-----	-----	-----
Poplar Creek-----	60.670	36.53	1.750	0.780	1.750	-----
Poplar Creek-----	59.470	40.00	0.530	1.260	-----	-----
Careyville (new mine)-----	56.860	38.89	3.190	-----	1.070	-----
Helenwood-----	54.240	41.29	2.640	-----	1.830	-----
Jellico-----	60.600	36.44	1.600	1.160	2.360	-----
Poplar Creek-----	56.120	39.33	2.810	-----	1.240	-----
Crooke Coal and Coke Company-----	61.660	34.63	2.140	0.88	1.670	0.017
Roane Iron Company (Rockwood)-----	60.110	26.62	11.520	1.49	1.750	-----
Roane Iron Company-----	60.760	32.59	5.270	-----	1.390	-----
Stanley (near Chattanooga)-----	61.730	26.70	10.210	0.530	1.360	-----
Sewanee (Tracy mines)-----	62.000	25.41	10.820	-----	1.770	-----
Sewanee, "-----	63.500	29.90	6.600	Trace.	-----	-----
Soddy Mines (Sewanee seam)-----	64.390	27.82	6.640	-----	1.150	-----
Emery Mines (Sewanee seam)-----	63.100	27.70	7.700	0.530	0.150	-----
Etna Mines (Kelly seam)-----	74.200	21.39	2.700	0.700	1.300	0.005

Dr. Peter.
 Regis Chauvenet.
 {Furnished by H. S.
 Chamberlain, President
 Roane Iron Company.
 No analysis given.
 Robertson.
 H. T. Yaryan.
 Prof. T. E. Wormley.
 McCreath & Poble.

Analyses of Tennessee Cokes.

NAME OF COAL.	Fixed Carbon.	Ash.	Sulphur.	Moisture.	Phosphorus.
Sewanee seam (Tracy City)-----	83.364	15.440	0.142	-----	-----
Etna (Kelly)-----	94.560	4.650	0.790	-----	0.008
Rockwood-----	84.187	14.141	0.182	-----	-----
Dayton-----	84.150	14.880	-----	-----	-----
Poplar Creek-----	90.060	5.000	0.570	0.010	0.010
Poplar Creek-----	95.240	4.760	-----	-----	-----

W. J. Land.
 University of Cincinnati.
 W. J. Land.
 Potter & Riggs.
 Regis Chauvenet.

III.—ACCIDENTS.

Although I only entered upon the duties of Inspector of Mines in September, 1885, I have endeavored to collect as complete a list as possible of the killed and injured in and around the mines of Tennessee from January, 1885, to June 1, 1886. This list is necessarily incomplete, as there is no record, nor is it possible to learn the date or other particulars of some accidents which may have occurred during the early part of 1885.

My object in thus collecting and compiling the accidents prior to September, 1885, is to cover a period of sufficient length to show the general causes of accidents in our mines.

Of the twenty-two accidents to persons recorded, eight occurred prior to September, 1885, and fourteen occurred during the period from September, 1885, to June, 1886.

Six deaths have occurred, due to four separate accidents, three of which resulted in the death of one man each, and the other in the death of three men. Only the last accident occurred since September, 1885.

Accidents from January 1, 1885, to June 1, 1886.

No.	NAME OF COMPANY.	NAME OF PERSON.	SOCIAL CONDITION.	DATE.	CAUSE OF ACCIDENT.	EXTENT OF INJURY.
1	Knoxville Iron Company.	Frank Moorfield.	Convict.	April 25, 1885	Crushed by engine.	Died.
2	Knoxville Iron Company.	Joe Dale	Convict.	Feb. 14, 1886	Fall of fire clay	Leg fractured.
3	Coal Creek Coal	John McKenney	Married	Dec. 22, 1885	Fall of slate	Recovered.
4	New River Coal	John Clark	Single.	October, 1885.	Fall of fire clay	Leg hurt.
5	Tenn. Coal, Iron & Rail'r'd	Claibore Irwin	Single.	April, 1885	Fall of slate	Leg broken.
6	Tenn. Coal, Iron & Rail'r'd	Jno. Tucker	Single.	July, 1885	Fall of coal	Leg broken.
7	Tenn. Coal, Iron & Rail'r'd	Jas. Northcut	Single.	February, 1886	Fall of sandstone	Leg broken.
8	Tenn. Coal, Iron & Rail'r'd	Adelbert West.	Convict.	April 23, 1885.	Fall of top	Thigh broken.
9	Tenn. Coal, Iron & Rail'r'd	Sol. Robertson	Convict.	July 7, 1885	Fall of top	Back hurt and ankle broken.
10	Tenn. Coal, Iron & Rail'r'd	Demier Wales (colored)	Convict.	Dec. 19, 1885	Fall of top	Back and ankle broken, shoulder dislocated.
11	Tenn. Coal, Iron & Rail'r'd	Charley Metlock (col)	Convict.	June 3, 1885	Fall of slate	Killed.
12	Daisy Coal & Coke Co	J. H. Allen	Married	Sept. 11, 1886	Treadle fell on him	Recovered.
13	Daisy Coal & Coke Co	Jack Renno	Married	Dec. 15, 1886	Str'k by rope on incl'e	Recovered.
14	Daisy Coal & Coke Co	Mrs. J. W. Killgore	Married	March 15, 1886	Car on incline	Foot crushed.
15	Daisy Coal & Coke Co	Mrs. Hart	Widow	March 15, 1886	Car on incline	Side and arm bruised.
16	Soddy Coal	Wm. Owens	Married	March 11, 1885	Fall of slate	Killed.
17	Soddy Coal	John Carney	Married	June 15, 1885	Barrel oil fell on him.	Leg broken.
18	Soddy Coal	Wm. Lloyd	Single.	May 24, 1886	Explosion of powder	Killed.
19	Soddy Coal	David Harper	Married	May 24, 1886	Explosion of powder	Killed.
20	Soddy Coal	Isaac Ramey (col.)	Married	May 24, 1886	Explosion of powder.	Killed.
21	Soddy Coal	Isham Lasley	Single.	June 8, 1886	Run ovr r by coal car	Fingers cut off.
22	Roane Iron	W. L. Nelson	Married	Sept. 23, 1885	After-damp	Recovered.

CAUSE OF ACCIDENTS.

The following shows the number and per cent. of accidents due to the various causes:

CAUSE OF ACCIDENTS.	No. of Injured.	Per cent.
Fall of coal, slate or fire clay-----	11	50
Hurt on tracks-----	5	23
Explosion of powder-----	3	13
After-damp-----	1	5
Otherwise-----	2	9
Total-----	22	100

	No. of Accidents.	Per cent.
Inside mines-----	13	59
Outside mines-----	9	41
Total-----	22	100

ACCIDENTS DUE TO FALLS OF SLATE AND COAL.

Fifty per cent. of the accidents are due to the falls of the roof of the mines or of coal. The number of accidents of this class which occur in a mine is not always a correct exponent of the care taken to prevent them. Some collieries are much more liable to roof-falls than others, and therefore record more accidents, although greater care is exercised to prevent them; but roof-falls are common to all mines, and cannot be entirely avoided. They are especially occasioned by loose pieces of shale or rock adhering to the roof, and, when the roof is fair, by inattention to the proper placing of props, by driving breasts too wide, by improper removal of props, by badly located shots spending their force on the roof, and by the vibrations of shots fired in adjoining workings. Frequently falls of coal are occasioned by improper underholing, or taking up the bottom and allowing too large a mass of unsupported coal above the

miner. Fire-clay, a very dangerous material indeed, occurs in some of our mines, as, without the least warning, it falls, and by its great weight crushes the miner.

Constant exposure to danger causes the miner to become careless, and the majority of casualties from roof-falls and falls of coal, are directly attributable to this carelessness, or the poor judgment of the miner, or to his reluctance to take the proper precautions, or exercise the proper care, because these involve some additional labor and trouble, for which he will, directly, receive no pecuniary reward.

Attention to proper and timely placing and renewal of props is of prime importance. The supervision of the placing, and the regular inspection of the props, should be intrusted to a thoroughly competent, experienced, and intelligent man, invested with the necessary authority to enforce his orders, and who should be held personally responsible for all such accidents occurring through carelessness under his jurisdiction.

ACCIDENTS ON RAILROADS AND TRAMWAYS.

Twenty-three per cent. of the casualties are due to these causes. Of the five persons thus injured only one was fatally hurt, and the accident by which he lost his life was the only one which occurred inside the mines. This accident, by which a convict met his death, occurred in the mine of the Knoxville Iron Company, at Coal Creek. He was crushed against the wall of the entry by the locomotive used at that place to draw the coal from the mine.

Three accidents occurred on inclines without the mines, and one on the company's narrow-gauge near the tip-house.

EXPLOSIONS OF POWDER.

Three casualties are recorded as the effects of the explosion of powder. All of these were due to one explosion which occurred while the powder was being transported to the mines.

There is no record of a single accident due to the generally so common cause of premature or blow-out shots in blasting.

ACCIDENTS FROM GASES.

One accident only has occurred due to this cause, which did not result fatally, and this was not from the explosion directly, but from the after-damp following it. This was also the only explosion of fire-damp which has occurred.

ACCIDENTS IN DETAIL.

Accident No. 1.—On April 25, 1885, in the mines of the Knoxville Iron Company, at Coal Creek, a convict, Frank Moorfield, mule driver, was crushed to death by the locomotive. In the mines of this company a small locomotive is used to draw the coal from the main entry, and for this purpose enters the mine some distance. The victim, at the time, having his arms full of "sprags," was going along the entry, and stood against the wall to allow the train to pass. He was warned that the engine would strike him, but disregarded the warning, and the engine striking the "sprags" in his arms, crushed him against the wall, injuring his chest in such a manner as to cause death.

Accident No. 2.—February 14, 1886, a convict miner, in the mines of the Knoxville Iron Company, at Coal Creek, was crushed under a fall of fire clay, while mining coal. The accident resulted in the fracture of his leg.

Accident No. 3.—December 22, 1885, John McKinney, miner, was crushed by a fall of slate in the mines of the Coal Creek Consolidated Mining and Manufacturing Company, at Coal Creek. He recovered shortly afterward.

Accidents Nos. 4, 5, 6, 7, 8, 9, 10 and 11, were all caused by falls of top or coal. Of these accidents, only No. 11, Charlie Metlock, convict miner in the mines of the Tennessee Coal, Iron and Railroad Company, resulted fatally. Nos. 8, 9 and 10, resulted in permanent injury of the victims; all the balance recovering.

Accident No. 12.—On September 11, 1885, on the property of the Daisy Coal and Coke Company, at Daisy, J. H. Allen was employed in building a trestle, which fell upon him. Recovered in a short time.

Accident No. 13.—December 15, 1885, on the incline of the Daisy Coal and Coke Company, at Daisy, Jack Renno was struck by the wire rope and knocked senseless, but recovered.

Accidents Nos. 14 and 15.—On March 15, 1886, Mrs. J. W. Killgore, the wife of the mine boss, and Mrs. Hart, her mother, entered an empty car on the incline of the Daisy Coal and Coke Company, with the intention of riding to the top. On several occasions they had been refused permission to ride upon the cars, and in this instance entered the car without the consent of the man in charge of the incline. Before the top of the incline was reached the car containing the women ran off the track, crushing the foot of Mrs. Killgore and bruising the side and arm of Mrs. Hart. They both recovered without permanent injury. The inspector was on the ground shortly after the accident, and an investigation developed the above facts.

Accident No. 16.—March 11, 1885, Wm. Owens, miner, was killed by a fall of slate in the mines of the Soddy Coal Company, at Rathburn. This accident occurred before I was appointed Inspector, and I have been able to obtain no further reliable information concerning it.

Accident No. 17.—At the mines of the Soddy Coal Company, on June 15, 1885, a barrel of oil fell from a wagon upon the leg of John Carney, causing a fracture of the limb.

Accidents Nos. 18, 19 and 20.—On May 24, 1886, an explosion of seventy-five kegs of powder occurred at Soddy, which resulted in the death of Wm. Lloyd, engineer; David Harper, fireman, and Isaac Ramey (colored), miner, the only fatal accident since my appointment. I received a telegram from the company at the time of the accident, and went out to the mines and made investigation with the following result: The Soddy Coal Company has been accustomed, for a number of years, to receive powder by the river at their wharf, which is transported thence in cars over their narrow-gauge railroad to the mines, across the Cincinnati Southern Railroad. On May 24, the company received a consignment of powder and it had all been carried to the mines except three car-loads, which Wm. Lloyd took up as far as the shops of the company, at one trip, as it

was the last of that day, although it was the custom to carry only one car at a time. A thunder storm was prevailing at the time, and he left one car at the shops of the company and started to the mines with the other two. He had proceeded but a short distance when the powder in the cars being transported exploded, causing the death of Wm. Lloyd, engineer, and David Harper, fireman, and also injuring Isaac Ramey, a colored miner, who was passing at the time of the explosion, so that he died the next day. I summoned M. L. Jenkins, superintendent, A. H. Levi, foreman at the wharf, and T. J. Reneau, who on oath testified as follows:

M. L. Jenkins, superintendent, said:

"The accident which resulted in the death of W. T. Lloyd, engineer, David Harper, fireman, and Isaac Ramey, colored, miner, occurred on May 24, on the narrow-gauge track of the company, from the wharf to the mines, about one-quarter of a mile from the mines. I came up from my house on the train, but jumped off to get my umbrella just before the explosion occurred. There was from seventy-five to eighty kegs of powder on two cars. The kegs were in the cars and covered with tarpaulins. It has been the custom of the company to furnish these tarpaulins to cover the cars carrying powder. I think, as a thunder storm was prevailing at the time, that the explosion was caused by lightning. When the explosion occurred I was in two hundred yards of the train, and was among the first on the spot. The tarpaulins were burning and the sides of the cars were blown off, but the cars and locomotive still remained on the track. Both the engineer and fireman had just started from the engine toward me as I first saw them. They were burned, and their clothes all off of them. Myself and Mr. Reese took these men to a house near by and called a physician, and did every thing possible for them. After their wounds were attended they were carried home on the train. They both told me they were blown nearly out of the windows, and ran into the water to put out the fire on their clothes. W. T. Lloyd died about 12:10 A. M., May 25; David Harper died about 2:30 A. M., May 25. Isaac Ramey said he was coming down from the mines, and as he was pass-

ing the train the explosion occurred. He was burned from the waist up, and said he went into the water to put out the fire on his clothes. Some other parties discovered him as he was coming out of the water, and brought him down. I have always cautioned the men to be careful in handling powder, and Mr. Lloyd, the former superintendent, had done so before me.

[Signed],

"M. L. JENKINS."

A. H. Levi, foreman at the wharf, said :

"There was at the wharf seventy-five or eighty kegs of powder, and my men and myself had loaded a car which had been taken to the mines on the trip before the explosion. I had a car loaded ready for them to take upon the last trip. The engineer, W. T. Lloyd, had instructed me to load only one car each trip. It had been the custom to take only one car of powder up at each trip, except sometimes on the last trip, when two cars were taken. The engineer, fireman and brakeman, when they brought the engine down to take back the last trip, added some powder to the car already loaded, and loaded the balance of the powder on two more cars while I was down on the barge. There were two kegs which had been broken, and I had those kegs set aside so that they could be fixed or wrapped up before being put in the car, so as to prevent any sparks from coming in contact with the powder. I also had them set aside to prevent a spark from passing engines from igniting them. It has always been the custom to wrap up broken kegs so as to secure them from accident. I was down on the barge while the cars were being loaded, and called to Mr. Lloyd to know whether he was going to take powder, or what he was going to do with it. I supposed he did not understand me, and I called to him that it was the powder I was talking about, and he answered that he understood, and said he was going to take it if he had room. This was all I knew until I heard of the explosion.

[Signed],

A. H. LEVI."

CROSS-EXAMINED.

Question.—How long have you known the company to carry powder in this way?

Answer.—It has always been the custom since I can remember; thirteen or fourteen years.

Q.—Was it always the custom to cover these cars with tarpaulins?

A.—Yes.

Q.—Were all the three cars covered with tarpaulins?

A.—From the distance I was away I could not be sure whether the tarpaulins were all over the cars or not, but as well as I could see they were covered all over.

Q.—How large were the tarpaulins?

A.—Large enough to cover the cars all over and fall around the sides, and there was a separate tarpaulin for each car.

Q.—Do you think it was possible for a spark to burn through the tarpaulins?

A.—The tarpaulins were wet from the rain, and I do not think it possible, without being discovered by the men. Besides, it was raining on and off all the evening. I went home as the train left, and a thunder-storm occurred just after I got home.

Q.—Were the broken kegs of powder wet?

A.—They had been sitting out exposed to the rain, but as I did not go to them to see if the powder was wet, I cannot be sure, but think it must have been wet somewhat.

T. J. Reneau, employe at the wharf, said:

“I was present at the time the powder was loaded. I helped load one car while the train was gone, and after the train came back, and while we were dumping the coal they had brought down, the engineer, fireman and brakeman loaded one car, and partly another, with powder. After we had finished dumping the coal, we went to where the powder was being loaded, but I did not help load any. The hand who was working with me helped load. I stood around fifteen or eighteen feet from them. I heard Mr. Levi say something concerning the broken kegs to Mr. Lloyd, but did not understand Mr. Lloyd's reply, though after loading the balance of the sound kegs he sent

down some of the hands for the bursted kegs. I spoke to them, feeling the danger of the matter, and said, 'Billie, don't put those bursted kegs in the car, for it is dangerous.' He laughed and made light of it, and turned with the keg he had in his hands, and either put it in the car or had it done by one of the hands. I said to him, 'There will be a Welshman killed, for there is danger in that powder.' I told the brakeman to watch out, and he said he would get on the hind car.

[Signed],

"T. J. RENEAU."

CROSS-EXAMINED.

Question.—Was this the customary way to carry powder?

Answer.—It has been the custom ever since I have worked for the company, and tarpaulins have always been provided to cover the cars.

Q.—Were all the cars covered?

A.—Yes, each with a separate tarpaulin. Mr. Lloyd and myself doubled the tarpaulin over the car next to the engine, and it was very wet.

Q.—Was Mr. Lloyd careless in handling the powder?

A.—He seemed to me to be very much so.

Q.—Is this the first accident with powder?

A.—Yes; this was the first which has occurred.

VERDICT OF THE CORONER'S JURY

in the case of Wm. T. Lloyd, was as follows:

"Death was caused by an explosion on the Soddy mine railroad, while hauling powder from the river to the mine. [Signed], R. Rees, Wm. Rees, John Haller, J. W. Davis, William Penny, T. W. Price, Ben Davis, jurymen. Thos. Reneau and Henry Levi, witnesses."

In the case of David Harper, death was produced as in case of W. T. Lloyd, and jury and witnesses same.

In the case of Isaac Ramey, the verdict was that he came to his death from burns and injuries received by an explosion of

powder, while said powder was being transferred from the river to the mine on the Soddy Coal Company's narrow-gauge railroad, on the 24th inst. [Signed], Lawson Henley, A. J. Brown, R. L. Jones, George Elker, Sandy Hutchins, Charles Springs, Jack Adams, jury-men. Gen. Mitchell and L. Huson, witnesses,

Accident No. 21.—June 8, 1886, on the narrow-gauge track of the company at Soddy, Isham Lasley, brakeman, was knocked from the coal cars by the limb of a tree, and his hand run over, by which he lost three fingers.

Accident No. 22.—On September 23, 1885, an explosion occurred in the mine of the Roane Iron Company, Rockwood. No one seems to have been near at the time, and it is not known how the accident occurred. Mr. W. L. Nelson, the mine boss, fearing some one was in the mine injured, entered where the explosion occurred, and being overcome by the after-damp, barely escaped with his life by dragging himself along. After several days sickness he recovered.

IV.—THE MINING LAW.

MAPS.

All of the companies operating mines in the State of Tennessee, with a few exceptions, have sent in maps of the workings to the Inspector before the two months' notice has expired. There are, however, a few delinquents who have allowed the time to lapse, and I have deferred taking active steps against them, as it would be a misfortune not only to the operators but also to the miners. I am satisfied the few remaining companies which have failed to send in maps will do so immediately, and I have, on account of the miners alone, allowed them a short respite.

OUTLETS.

Section 3 of the mining law requires that two openings be accessible to the miners in every mine. The question has arisen whether a shaft with a furnace at the bottom, constitutes, in the eyes of the law, an opening. Should this be the case, there is no mine in the State which, in this respect, does not comply with the law; if otherwise, there are several to which there will have to be added an opening.

VENTILATION.

Section 7 of the mining law requires fifty-five cubic feet per second, or thirty-three hundred cubic feet per fifty men, per minute, of air to be circulated through and to the face of each and every working place. This clause of the law is not absolutely complied with in any instance. It is hardly practicable to circulate the air to the *face* of every working place. For instance, the entries when being "driven" must proceed a certain distance before connection with the air-way is established. All that is necessary is to make the connections with the air-ways

or cross-cuts at sufficiently frequent intervals, varying with the mine and surrounding circumstances, to insure the carrying off of all noxious gases which may accumulate in the face of the entry.

Again, let me enter a strong protest against the too frequent dependence on natural means alone for ventilation. There may be a sufficient quantity of air passing at the time of the visit of the Inspector, but this quantity may not be, and, I fear, is not kept up at all times of the year.

I am glad to be able to say that the ventilation of the mines of our State has greatly improved within the last few months, and in some instances I have been the recipient of the thanks of the miners for this improvement. It has been my endeavor to interest the miners in my work, and gain their aid in the prosecution of the work, as with their assistance the work of improvement will progress much faster. In a few instances fear of the company has held them back, but in many cases I have succeeded in establishing a confidence which I feel sure will increase with time.

INQUESTS AND INVESTIGATIONS.

Section 12 of the mining law requires that the Inspector of Mines shall investigate the causes of the death of any person or persons in or around the mines of the State. Only in one instance, that of the explosion of powder at Soddy, by which three men lost their lives, have I been called upon to make an investigation. I received promptly a telegram from the company, notifying me of the mishap. I repaired to the scene of the accident and made an official examination as to the circumstances and causes of the death of the three men, summoning the principal witnesses and making a thorough investigation. (See "Accidents.")

THE LAW IN GENERAL.

It is nothing but just and right that the coal miner, subject to so much danger in the extraction of coal from the earth, should have the protection of the law so as to lessen, as much

as possible, these dangers, and protect him from the criminal negligence of others. The managers and operators of mines, in their haste to extract the valuable mineral from the earth, in most instances will, unless compelled by law, neglect to establish an efficient ventilation, especially in the laying out of new works. While the value of the law, as it is, can hardly be estimated, still I would respectfully suggest that it be revised, certain parts added to and others stricken out, so as more fully to conform to the requirements of the collieries of Tennessee.

CALLS FOR INSPECTION.

I have received from Mr. Cain, Superintendent of the State Prison, two calls for special inspections; one through H. T. Patton, warden, at Tracy City, and one through H. M. Moore, warden, at Coal Creek. I immediately repaired to these places. At Tracy City the convicts are employed in the Lone Rock Mine, and average a working force of about two hundred men. Mr. H. T. Patton, warden, and Dr. R. B. Owens, resident physician, stated to me that considerable sickness had lately shown itself among the prisoners, and fearing it might have been occasioned by an inefficient ventilation, they had summoned me to make an investigation.

At the time of my visit a quantity of air equal to the requirements of the law was circulating through the mine, but no excess. The "entry drivers" were compelled, in some cases, to work too far ahead of the air, but I saw nothing which, in my opinion, could have occasioned the sickness, unless the amount of ventilation had been increased before my visit.

The company is now at work on a new ventilating shaft, which will, at all times, insure a good system of ventilation.

Since I left Tracy City I have received a communication from Mr. Moore, stating that there has been no sickness among the convicts since the inspection of the mine.

At Coal Creek 125 convicts are employed in the mine of the Knoxville Iron Company, and Mr. Moore, the warden at that place, informed me that some sickness had occurred lately

among the prisoners, and he and Mr. Cain were anxious to know if the ventilation was in good condition. I found the amount of air circulated even greater than when the mine was last inspected, and also free from smoke, owing to the change in the system made last fall.

I have also received a request to make an inspection of an iron ore mine, but as this class of mines is not provided for by the law, I declined to act in the matter.

NOTES OF IMPROVEMENTS.

The Tennessee Coal, Iron & Railroad Company will shortly make a series of experiments to determine the general utility, both in theory and practice, of the new coke ovens designed by Mr. F. P. Clute, resident engineer. It is thought that the ovens will produce first-class coke with only twenty-four hours' burning, and should this prove true, the company will add a number of these ovens to its plant.

The Tennessee Coal, Iron & Railroad Company will shortly put in a stationary engine and wire rope in Lone Rock mine, to draw the coal from the mine.

The same company is now building a new upcast shaft and furnace to improve the ventilation of Lone Rock mine, and will also soon build one at East Fork mine.

The *Ætna* Coal Company is engaged in opening a new mine.

The Tabler-Crudup Coal & Coke Company is adding to the number of its coke ovens.

The Soddy Coal Company, a short time ago, doubled its output of coke.

The same company will immediately commence building a new upcast shaft and furnace at mine No. 3; also, expects soon to put up a stationary engine and wire rope in No. 3, to draw the coal from the mine.

Numerous improvements are still progressing at the Dayton Coal & Iron Company's works.

The Roane Iron Company is building a new broad-gauge ore road.

The Standard Coal & Coke Company has lately built a new upcast shaft and furnace in its mine, which has greatly improved the ventilation.

The Coal Creek Consolidated Mining Company has lately sunk a new upcast shaft and built a furnace in the Empire mine, greatly improving the ventilation.

The Coal Creek Consolidated Mining Company is contemplating putting up a stationary engine at the Empire mine, with wire rope, to draw coal from the mine.

The Knoxville Iron Company has made an entire change in its system of ventilation, thus getting rid of the smoke in the mines, and improving the ventilation.

V.—MINE GASES AND VENTILATION OF MINES.

In the following remarks I have endeavored to present to the mind of the practical miner a general knowledge of the laws and principles of ventilation, as applied to the mines of this State, and of the nature and properties, chemical and physical, of some of the gases most frequently encountered in coal mines. In its preparation I have made free use of the information contained in works and essays written by acknowledged authorities on the subjects.

A variety of gases is given off by coal and other minerals met with in coal mines; and a further and, in the coal mines of Tennessee, a very important part of the gases arise from the breathing of men and animals, and from the burning of lamps and gob fires as well as from the explosion of the powder used for blasting the coal and stone in the mines.

Some of the gases given off in coal mines, although fire-damp is rather the exception than the rule in the mines of Tennessee, when mixed with certain proportions of air, form violently explosive mixtures. On the ignition of this mixture of gas and air by a naked lamp a violent explosion occurs, producing one mass of living flame, scorching and burning everything that may happen to be within its reach. The flames of such an explosion being extinguished and its violence exhausted, there remains an atmosphere so hot and so charged with noxious gases and steam as to cause the death of all who are left alive to inhale or breathe it. This resulting atmosphere is generally termed *after-damp*.

Although black-damp, the commonest gas in the mines of Tennessee, seldom causes immediate death, still to continually be compelled to breathe air vitiated with it, has a very injurious effect on the constitution, which is sure to be felt in time.

The entry drivers were often compelled to work in air where it was difficult to keep a light burning, so far are the entries driven ahead of the air. But I am glad to say a marked improvement in this respect has taken place within the last few months.

There is no need that such a state of things should ever occur, as the remedy is so simple.

The air courses are often driven too small for the duty required of them ; and irregular, the roof and sides being rough and carelessly driven—often needlessly turned at sharp angles—the floors filled with waste, and I have often seen empty cars allowed to remain standing in air courses, thus shutting off a great deal of air which is so much needed.

The grand object of the ventilation of mines is to cause such a current of air constantly to circulate through them as shall, by mixing with and diluting the gases, render them harmless, and in that state, carry them off as quickly as they are produced in the mines.

MINE GASES AND EXPLOSIONS.

Fire-damp, often improperly called “sulphur” by the miner, is a name applied to any combustible gas found in a mine other than “white-damp” or carbonic oxide. In a great majority of cases it consists of light carburetted hydrogen, or, as it is sometimes called, marsh gas, which contains one atom of carbon combined with four atoms of hydrogen, but in some cases also contains hydride of ethyl (two atoms of carbon and six of hydrogen), hydride of propyl (three atoms of carbon and eight of hydrogen), or quartane (four atoms of carbon and ten of hydrogen).

As found in mines fire-damp is often mixed with small quantities of sulphuretted hydrogen (composed of two atoms of hydrogen and one of sulphur), and when ignited, on this account evolves an unpleasant odor, from which it has derived its common name of “*sulphur*.”

The specific gravity of marsh gas is 0.5576, and it is eight times as dense as hydrogen. One thousand cubic feet of it at 32° F. and 30 inches barometer, weigh 44,665 pounds.

Owing to the fire-damp of mines being hardly more than half as heavy as an equal volume of air under the same conditions, it lodges next to the top or roof in mines until, by diffusion, it gets quite mixed with the air.

Although, if breathed in a pure state, this gas would cause death from suffocation, still it may be breathed, when mixed with twice its volume of air, for a considerable time without serious effects.

Air approximately consists, by volume, of four parts of nitrogen and one part of oxygen, and for the complete combustion of marsh gas, ten parts of air are required to one of gas, or two parts of pure oxygen to one of marsh gas.

When one part of fire-damp is mixed with thirty parts of air, the presence of the gas may be detected by the appearance of the flame of a candle. When the amount of fire-damp reaches one part in thirteen of air the mixture becomes explosive, so that when ignited by any uncovered light it becomes a mass of flame, but the force of the explosion is comparatively feeble. When the amount of fire-damp reaches one in nine or ten parts of air by volume, the force of the explosion is greatest, and, as the amount of fire-damp increases, the violence of the explosion decreases, until the fire-damp reaches one in five of air, when it will no longer explode, but burn quietly. When the amount of fire-damp increases above this ratio, the mixture will extinguish a light immersed in it.

The explosion of fire-damp produces what is known as

After-damp, which is composed of carbon dioxide or black-damp, water in the form of vapor and a large quantity of nitrogen, and sometimes of carbon monoxide or white-damp and free hydrogen. The composition of after-damp varies greatly with the per cent. of air in the mixture of fire-damp and air which had been exploded. Should the mixture contain only

the requisite amount of air for the complete combustion of the fire-damp, only black-damp, water and nitrogen would remain as after-damp.

The conditions are such that there could never be a sufficient quantity of air present at the time of an explosion to render the after-damp fit to breathe.

DETECTION OF FIRE-DAMP.

The surest test of the quantity of fire-damp in a mine is by the appearance of the flame of the lamp.

The lamp wick, after being carefully trimmed, should be drawn down until the flame consists only of a small blue hemisphere, $\frac{1}{8}$ inch high and $\frac{1}{4}$ inch in diameter at the base, with a conical speck of yellow at the middle, near the top.

One part by volume of fire-damp to 30 of air, a conical cap of a blue color about $\frac{1}{4}$ inch high, appears on the flame; 1 to 25, a conical cap $\frac{1}{2}$ inch high; 1 to 20, a cap $1\frac{1}{4}$ inch high, with nearly parallel sides about $\frac{2}{3}$ of its height, and drawn out to a point at the top—the cap is perfectly steady and more distinct than the others; 1 to 18, a voluminous waving, spindle-shaped blue cap, 2 inches high; 1 to 16, a similar cap, $3\frac{1}{4}$ inches high.

The presence of black-damp causes the flame to appear more or less brown, and also lessens the violence of the explosion.

WHITE-DAMP, OR CARBONIC OXIDE,

consists of one atom of carbon combined with one of oxygen. Its specific gravity is .968. One thousand feet of air at 32° F., and 30 inches bar., weigh 80,728 lbs., and an equal volume of this gas, under the same conditions, weighs 79,426 lbs.

White-damp has a much more deleterious effect on the animal economy than black-damp, or carbon dioxide. It is an exceedingly poisonous gas, acting almost instantly upon the system as a narcotic. Air, which contains more than one per cent. of carbonic oxide, almost immediately causes the death of warm-blooded animals, while air containing 8 to 10 per cent. of black-damp may be breathed a considerable time without serious effects.

Carbonic oxide is itself an inflammable gas, but does not support combustion of other bodies. It is easily kindled, and burns with a pale-blue flame, being transformed into black-damp or carbon dioxide by the process. As found in mines, it is the result of the explosion of powder, or as a part of after-damp, or resulting from gob fires.

White-damp is seldom found except mixed with other gases, and when produced by an explosion or gob fires, it is always accompanied by more or less carbon dioxide or black-damp. There is no trustworthy method of determining the presence of white-damp.

BLACK-DAMP,

or carbonic acid gas, or carbon dioxide, is composed of one atom of carbon and two of oxygen. Its specific gravity is 1,524, or about one and one-half times as heavy as air; it therefore quickly sinks to the floor of entries and settles in the lowest parts of the workings. Black-damp is of necessity found to a certain extent in all mines, being given off by the coal, caused by the explosion of gunpowder, exhaled by men and animals, by gob fires, and also produced by explosion of fire-damp as a part of the after-damp.

Air containing 8 or 10 per cent. of black-damp may be breathed for a considerable time without serious effects, and as a much less quantity can be detected by the feeble burning of a lamp or by its extinguishment, the danger of casualties from the presence of this gas is much less than that of carbonic oxide.

Standing or walking in this gas occasions a feeling of numbness in the legs, followed by headache and sometimes by nausea.

The constant breathing of air mixed with very small quantities of this gas is very deleterious to the health of the miners.

SULPHURETTED HYDROGEN

is very rarely met with in appreciable quantities in the mines of this State, but is sometimes met with in considerable quantities in mines.

It is composed of two atoms of hydrogen and one of sulphur. Its specific gravity is 1.175, being somewhat heavier than air. It burns when exposed to a supply of air and ignited, and when mixed with oxygen gas the mixture is explosive.

A very small quantity breathed with air is said to have a very fatal effect on some animals, but a considerable quantity is necessary to produce any sudden effect on man; still it must be admitted that the continual inhalation of even very small quantities, will be surely followed by some constitutional trouble. It is produced where pyrites are undergoing decomposition in mines, and also in small quantities by explosions of gunpowder, and by gob fires. It is easily detected by its odor (that of rotten eggs).

VENTILATION.

The coals of our State, with a very few exceptions, lie horizontal, and with very little trouble and slight expense, it is possible to establish and maintain a perfect ventilation. The motive power by which the mines are ventilated is in all cases by furnaces, except in those instances where only natural means are resorted to. The entries are driven in on the vein of coal, the mouth of the main entry being in the majority of cases the "intake" for the air and a shaft is sunk at some convenient point to tap the works. In the bottom of this shaft a furnace is built by which the air in the shaft is heated, thus affording the pressure for ventilation. The length of this column of heated air varies from twenty to one hundred feet, and is, in the great majority of cases, highly sufficient to afford the necessary pressure. In nearly every case of a mine ventilated by a furnace, and having defective ventilation, the defect is due to errors in the system of ventilation, and not the lack of sufficient pressure. In some cases the defect is in the unnecessary complexity of the system, the friction of air being many times what it should be on account of the distance it is compelled to travel, and the many turns and windings which it must traverse. In others, leaky doors and brattices are the great defect to be contended with. In others the defect is due to the contraction of the air-ways, for I have seen some through which it was

difficult to crawl. Sometimes dirt and waste are allowed to accumulate in them to such an extent as to almost close them up. In fact, in very few cases indeed is any attention at all paid to that very important factor in the ventilation of mines,

THE FRICTION OF THE AIR.

In order to present to the mind of the miner how very important it is to reduce the friction to the very lowest possible amount in order to obtain a good ventilation, I will briefly refer to the result of some experiments conducted in some English collieries :

In Hetton colliery, first case, 18-19 of the total ventilating pressure was required to overcome the friction, and only 1-19 to produce the velocity of the ventilating current. In the second case, same colliery, 17-18 was required to overcome friction alone.

In Haswell colliery 10-11 was expended in overcoming the friction of the air.

In Tyne Main colliery $\frac{1}{3}$ of the ventilating pressure was expended in overcoming friction and $\frac{1}{3}$ in producing the velocity.

From these examples it will be perceived that the amount of ventilation in mines, and, therefore, the health and comfort of the miners, and often their very safety, depends almost entirely upon the amount of friction that the air meets with ; and hence the great importance of reducing such friction to its lowest possible amount, and by this means obtain the greatest quantity of air from the ventilating power used.

One of the essential principles of an efficient ventilation is, that spacious air-ways are indispensable. The pressure necessary to overcome the friction in the same air-way varies as the square of the velocity.

That is, say to double the velocity of the air it is necessary to increase the pressure four times, or to treble the velocity it is necessary to supply nine times the pressure. In the same way one-half velocity meets with only one-quarter of the resistance ;

and one-third velocity meets with only one-ninth of the resistance. Thus it is evidently of great advantage to drive the air-ways of such a size as to pass the necessary amount of air without it attaining a very great velocity. For an example, suppose we adopt 360 feet per minute as the desirable velocity, and the amount of air necessary for the mine 12,960 cubic feet. The area of a section of the air-way should equal 12,960 divided by 360, which equals 36. Therefore the section of the air-way should contain 36 square feet, or be six feet high and six feet wide.

The corners at the necessary turns in the air-ways should always be rounded off, and the resistance reduced as much as possible, and all projections of stones and timbers should be avoided.

Another important fact connected with the dimension of air-ways is, that the return passages require a larger sectional area than the intake passages. During the passage of the ventilating current through the mine it becomes laden with various gases, watery vapor and dust; besides it has become heated (at least during a great part of the year), and consequently its bulk is considerably increased, and the friction, in case the return air-way is not larger than the intake, would increase as the up-cast is approached.

To sum up the conditions of a good system of ventilation, assuming the pressure to be sufficient, we have,

1st. The air-ways should be driven the shortest route possible, avoiding passage through old workings and a winding, sinuous course.

2nd. They should be of sufficient size to allow the passage of the necessary amount of air at a low velocity.

3d. All unnecessary turns should be avoided, and in necessary ones the corners rounded off and the resistance reduced to a minimum.

4th. The air-way should be kept clear of all waste, and the walls smooth and free from all such obstructions as projecting timbers and stone.

5th. The sectional area of the return passages should be increased as the upcast is approached.

NATURAL VENTILATION.

When a mine is spoken of as having natural ventilation, we understand the term to mean that no artificial means are used, either furnace or otherwise, to cause a current of air to circulate through the mines.

To say the least, ventilation secured thus is always poor and unreliable, still I am compelled to acknowledge that in many of the mines of this State no artificial means are resorted to in order to secure, whatever may be the condition of the weather, a reliable ventilating current, and supply the miners at all seasons with a sufficient quantity of fresh air.

In many of the smaller mines many of the entries are driven "out to daylight," with the idea that by this means good ventilation will be secured.

This is a very grave fallacy. Under certain favorable conditions a good current may pass through the mine, but especially in the spring and fall, when the temperature of the mine is the same as the air outside, the ventilation of the mine will depend entirely on the motion of the cars and the wind. Even the currents entering the mine meet and counteract each other. This method of ventilation is especially objectionable in shallow drift mines where the coal is level.

In a few of the mines, indeed, shafts have been sunk as upcasts for the ventilation, which, on account of the difference of level between the mouth of the mine and the top of the outcast, produce a difference of atmospheric pressure sufficient, during a great part of the year, to cause a good ventilating current to circulate. But even in these cases it is very advisable to have a furnace ready in the upcast in case the atmospheric condition should become such as to interfere with the ventilation.

I am very glad to say the reliance on natural means alone for ventilation has decreased to a considerable extent lately, and

hope soon to be able to report that no mine in this State is without an efficient system of ventilation.

TREATMENT OF INJURED MINERS.*

"In the case of fractured limbs, the injured member should be placed in a natural position, and one comfortable to the sufferer, and carried home on a stretcher. This should also be done in cases of dislocation, but the person may often best wait at the colliery until the arrival of the surgeon.

"In cases of severe bruises or contused wounds, and internal injuries, the patient may be carried home, great care being taken in moving him; but if his home is distant from the colliery, or a surgeon can be quickly called, it is best to wait until he arrives.

"Wounds on the head, and other superficial wounds, should be sponged out and thoroughly washed with cold water; if there is considerable hemorrhage hot water may be tried; if this fails use a mild astringent. * * *

"When the bleeding comes from an artery, the blood will spurt out in jets, and in this case an endeavor should be made to control the hemorrhage by pressure on the artery with the fingers.

"When the hemorrhage is from the leg or arm, a ligature should be applied. This may be readily accomplished by tying a handkerchief or muslin bandage loosely around the limb, above the wound, and twisting tight with a stick.

"When the hemorrhage is from a vein the blood is of a *dark color* and does not spurt out in jets. In this case the ligature is applied *below* the wound, if it cannot be controlled by pressure with the fingers.

"If the patient faints from loss of blood, and the hemorrhage has greatly decreased or stopped, place him flat on his back, *do not give him any stimulant* (brandy or whisky), and do not attempt to bring him to by dashing water on his face, etc. Let

*The matter under this head is taken from "Report on the Mining Methods and Appliances Used in the Anthracite Coal Fields," by H. M. Chance.

him lie perfectly still until the surgeon arrives. If the hemorrhage has been completely stopped by a ligature, efforts may then be made to bring the patient to by the use of cold water, ammonia, etc., and a small dose of whisky (one or two ounces), or an ounce of brandy may be given. *Place the head low.*

“If there is no hemorrhage, and the man is weak and nervous from the severe mental and physical shock which he has sustained, one or two ounces of brandy may be given to enable him to bear the journey home without fainting.

“Sweet oil and lime water, or linseed oil and lime water, are to be liberally and promptly applied on cotton or lint to all burns, and a little brandy may be given with advantage to enable the sufferer to rally from the shock.

“When a miner is found unconscious or apparently dead from the effects of black-damp or any other gas he may have inhaled, artificial respiration should be *immediately* begun and continued for fifteen or twenty minutes at least. Ammonia should be held near the nostrils and brandy given in a liberal dose. Cold water should be thrown on the face, or the face and chest may be slapped vigorously with a wet towel.

“In all cases of serious injury, the patient should not be moved to his home until the physician has arrived. When the injury is not serious, or is of a nature easily understood by the patient, he may be taken home as soon as he feels able to be moved.

“A seriously injured person should never be surrendered to his relations until the arrival of the physician, as they are less likely to treat him properly than any one else. They are excited and worried, and not capable of acting with discretion.

“Old experienced miners, who have seen dozens of accidents and who have acquired more or less experience in handling their injured fellow-workmen, should always be chosen in preference to others, to take charge of the injured and keep away officious and curious strangers until the physician arrives.”

THIRD SEMI-ANNUAL REPORT.

NOVEMBER 15, 1886.

HON. A. J. McWHIRTER, *Commissioner of Agriculture, Statistics,
Mines and Immigration:*

SIR—The mining law of Tennessee requires of the Inspector of Mines a semi-annual report.

It is my design to compile statistics once a year only, and in the spring to report the output, etc., for the previous year; in the fall to report the accidents for the previous six months, and give a brief summary of the condition of the coal and coke trade.

Hoping this will meet with your approbation, I am, most respectfully,

JO. C. GUILD,

Inspector of Mines.

I herewith beg to present a tabulated statement of the accidents which have occurred since June 1, 1886:

Table of Accidents.

No.	NAME OF COMPANY.	Name of Victim.	Date.	Cause.	Extent of Injury.
1	Coal Creek Con. Mining Co.	J. M. Elliot	July 5, 1886.	Fall of Slate.	Shoulder Broken.
2	Dayton Coal & Iron Co.....	Wm. Battomy.....	July 15, 1886.	Blowout Shot.	Fatal.
3	Standard Coal & Coke Co.....	Joe Rucker (col.)..	Aug. 19, 1886.	Fall of Slate.	Fatal.
4	Walden's Ridge Coal Co.....	John Frailey.....	Aug. 28, 1886.	Fall of Slate.	Leg Broken.
5	Tenn. Coal, Iron & R. R. Co.	Convict.	July 2, 1886.	Fall of Slate.	Arm Amputated.
6	Soddy Coal & Coke Co.....	John Boon.	July, 1886.....	.....	Finger " "
7	Soddy Coal & Coke Co.....	James Curtice.....	Sept., 1886....	.....	Leg " "

On February 23, 1886, at the mines of the Roane Iron Company, at Rockwood, Wm. Rutherford was killed by a fall of coal in the New Bank entry. Mention of this accident was omitted by mistake from my last report.

I am happy to report a very satisfactory decrease in the number of accidents.

From the above table it will be seen that only seven accidents have occurred during the last six months, two of which were fatal.

During the six months previous, twelve accidents occurred, four of which were fatal. Thus showing a decrease of 41½ per cent. in the number of accidents, and a decrease of 50 per cent. in the number of fatal accidents.

Of the seven accidents, four were caused by falls of slate.

This class of accidents is most generally caused by a neglect on the part of the victims to take sufficient care in the placing of props for the support of the roof, but often is unforeseen, and unavoidable.

Sometimes accidents of this class are caused by the fall of what is known to miners by the name of "sulphur balls," that is, a loose mass of slate imbedded in the roof of the mine which, unexpectedly falls out, causing often the death of the unfortunate miner who may chance to be beneath.

Accidents Nos. 1, 3 and 4, were caused in this manner.

Accident No. 2, occurred in Richland mine, near Dayton, and resulted in the death of William Battomy. He had lighted a blast, which failed to go off; he returned too soon, and it exploded with fatal results.

THE COAL AND COKE INDUSTRY IN TENNESSEE.

The demand for the Tennessee domestic coals has this winter shown a great increase over last year, and all the mining companies seem to be in a most prosperous condition. In most cases they are increasing their output to the extreme limit.

Better prices are paid for this class of coal, and the mines are generally in a more prosperous condition than they have been for some years.

I am glad to report that the number of companies mining this class of coal have materially increased.

The new companies are as follows:

The McNab Coal Company (reopened), fifteen miles below Chattanooga, on the Tennessee River; The Laurel Leaf Coal Company, at Oliver's Springs, Anderson County, Tenn.; The Helenwood Coal Company (reopened), Helenwood, Tenn., Jas. Frye, Manager, Helenwood; The Robbins Coal and Mining Company, Robbins, Tenn. (co-operative plan); two small new mines on the property of Col. J. M. Heck, at Coal Creek, opened by miners on the co-operative plan, making in all six additional mines, besides other mines to be opened to produce coking coal.

The increase in the price of iron has caused an increased demand for Tennessee blast-furnace coke, and in fact now, the demand is far greater than the supply.

The new mines now being opened, and to be opened in the near future, to produce coal for coking, are:

A new mine by the Etna Coal and Coke Company, three miles from their present mine, to which a railroad has been built, and they will, in a short time, greatly increase their output of splendid blacksmith coal and unexcelled foundry coke.

The Thomas mine, in the Sequatchie Valley, four miles from Victoria, where the Tennessee Coal, Iron and Railroad Company will mine coal to manufacture coke for their iron plant at South Pittsburg, to which they will add another furnace. The coke ovens will be near the furnace.

The Sequatchie Coal and Iron Company will open a mine thirteen miles from Victoria, and go into active operations in the spring.

It is also said that the extensive coal fields four miles from McMinnville are to be opened at an early period.

Thus we see that the new mines now in operation, or soon to be opened, are eleven in number; an increase of $33\frac{1}{3}$ per cent., which is, in our opinion, a very flattering result.

Altogether, the coal trade of Tennessee is in a far more flattering condition than it ever was before.

The increased demand for furnace coke has caused experiments to be made at several of the mines, whose coals have been previously considered unfit for the manufacture of coke, and with varying success.

The Standard Coal and Coke Company have met with considerable success in this line, and have produced a very good coke, but have not yet succeeded in making it of sufficient strength to bear the burden in a blast furnace.

The Glen Mary Coal and Coke Company are producing a good coke, and are selling to the Dayton Iron Company, and also ship, regularly, to California for silver-smelting purposes.

It is only a question of time, and the immense quantities of slack coal, now wasted at the mines which produce our domestic coal, will be utilized in this way.

The coal and coke of Tennessee production now find a market as far South as Texas, and as far West as California.

I beg to lay before you the statistics of the production of coal and coke from January 1, 1886, to December 1, 1886. I will give output by districts, as shown in my last report (Second Semi-Annual).

<i>Districts.</i>	<i>Coal (tons.)</i>	<i>Coke (tons.)</i>
I.....	154,216	134,724
II.....	359,232	161,235
III.....	422,000	.....
Total.....	985,448	295,959

The above is for only eleven months. There is a slight decrease in District II, owing mostly to the fire in the Rockwood Mines, and the mines just opened have, of course, been able to as yet ship very little coal.

The output of coke shows a marked increase. (The Dayton Iron Company are now building 150 additional coke ovens.)

The number of men employed has shown a marked increase, showing now 4,140, against about 3,500 of last year.

I am, most truly yours,

JO. C. GUILD,

Inspector of Mines.

REPORT
—OF—
JOHN W. GLENN,

Professor of Chemistry, University of Tennessee,

KNOXVILLE, TENN.,

—AND—
DIRECTOR OF THE AGRICULTURAL EXPERIMENTAL STATION.

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REPORT.

To HON. A. J. McWHIRTER, *Commissioner of Agriculture, Statistics, Mines and Immigration* :

SIR—I most respectfully ask to submit the following report :

Since our last biennial report many new experiments have been conducted at the State Station ; and all the old ones which promised any good results have been repeated for the purpose of reaching more exact conclusions.

Your space will no doubt be limited and we have not the time, at present, to engage in discussing the facts which are herein submitted for your examination and, with your approval, to the consideration of the farmers of Tennessee.

All who desire to have a full and comprehensive report of our work during the past two years, together with our discussion of the different sets of experiments will please apply to us for the forth-coming report to the Board of Trustees ; which report will be ready for distribution soon after the meeting of the next General Assembly.

We can give here only the most important series of experiments and those results which have been approximately determined and may prove of decided value to agriculture in our State.

WHEAT CULTURE.

This important crop has been given a most prominent position in our work at the Station, and about eighty experiments have been made to determine the best methods in the growth of this leading cereal. Many of these tests were repetitions to

obtain approximate results, where conditions necessarily varied. The operations in wheat culture were arranged and conducted in five different series, the number in each series varying from ten to thirty. The first series embraced

QUANTITY OF SEED.

This was varied from two pecks to nine pecks per acre, with all other conditions as nearly identical as our climate and soil will permit. If not otherwise stated, the wheat in all cases was drilled in rows nine inches apart. These and similar experiments have been conducted for seven years, and the best results obtained from all the lots through all the years came from those plats which were seeded with four or five pecks per acre according to variety, one requiring four and the other five pecks per acre.

THE TIME OF SEEDING.

We have made no exact tests as to this question during the two last seasons; but the fall of 1884 was so dry that our lands could not be seeded till about the 18th of November, and a large proportion of the plants were killed by the severe winter which followed. Last year wheat sown in September was attacked by fly or advanced too far before frosts; thus, both results have strengthened our former conclusions, that the best time for sowing hereabout is from the 10th to the 20th of October.

VARIETIES.

Some eight or ten varieties have been tested each year, but none have been found which give better general results in our soil and climate than the old and well-tried kinds, such as the Boughton, which is well known in all parts of Tennessee, and is too well known to require a description here. The Champion Amber, a tall growing, bearded variety, has, with us, given the best average crops during a period of seven years; and I notice similar reports of its superiority at other experiment stations where it has been tested. Another variety received from the United States Department, and hence named by us

"United States Amber," is a beardless wheat resembling in growth and general appearance Martin's Amber, and promises, after four year's trial, to be one of the hardiest, most prolific and generally most satisfactory among all the wheats that we have tested. "McGhee's White" and the "Extra Early Oakley" give very flattering promises, but our trial of them has been too short to authorize any indorsement. We can, as yet, only recommend that farmers test them in small quantities.

METHODS OF SEEDING.

Plats lying adjacent to each other, and otherwise treated in the same manner, have been seeded differently, and the results carefully compared. We tested the plan of dibbling for several years, but obtained no satisfactory results whatever. Some lots were seeded by drilling with rows nine inches apart, and others eighteen inches asunder, and over some of the plats the wheat was broadcast.

The best results came from the seed in rows nine inches apart; but the excess over the crop of the broadcast wheat was very slight, generally. Our experiments indicate that, plats well prepared before seeding, and then sown broadcast, will yield crops far greater than those gathered from Tennessee lands, generally, which are usually sown after "rough preparation," or commonly, very little preparation.

Wheat is a dainty feeder, and there is probably no crop which can be more increased by a thorough pulverizing and mixing of the soil before the seed are deposited. (See our large report in which this subject is extensively discussed.)

BARNYARD AND SIMPLE MANURES.

Glancing over this series of experiments extending over eight years, I find that almost every time stable manure, with a good amount of organic matter, gives by far the best results. I cannot say that such manures are cheapest; on the contrary, they

are the most costly, if conveyed to any considerable distance. Green manures, such as pea-vines and clover turned under, stand next in their results.

These facts clearly indicate that the wheat plant requires a large amount of humus, and active fermentation in the soil during the season of its growth. It seems to like a pancake warm and just from the griddle almost as well as corn does. A straw mulch often gives superior developments during winter, and a spring seeding of clover on such a mulch has for three times produced a growth which, to me, was most surprising. (This par parenthesis.)

Many of the simple manures gave good results, but nothing so remarkable that they should be distinguished by special mention in this report.

There is one thing stressed by all our experiments in plant food, and that is, the compost heap. Almost all economic plants, when fed with such food properly compounded, give us liberal returns always and everywhere.

We think it can hardly be pressed too earnestly upon the attention of the farmer that compost heaps are as essential to his crops as his barns and cribs are to his stock; and his plant food should be garnered as carefully as are his forage and grain.

COMMERCIAL FERTILIZERS.

These are efforts made by science to collect the rarer and more important elements of plant food into forms so concentrated that they can be transported at comparatively little cost across the country, just as condensed milk and concentrated meats are prepared for ships' crews when they expect to go on long voyages. Such fertilizers do not contain all of the elements of plant food, and, if used alone, will not produce a healthy, vigorous growth. They are not complete fertilizers for all soils and for every soil, and should not be so offered. They are intended only to supply certain deficiencies which are sure to occur in soils constantly cultivated and drained by annual

crops. If properly applied to soils so exhausted, these fertilizers will give most satisfactory results; but they must be used with discretion and on soils which already contain materials to supplement them into complete manures. They never can supply the place of humus, were never so intended, and on soils destitute of organic matter their application will almost certainly result in disappointment.

We are glad to state that a very decided improvement is exhibited in the commercial fertilizers since the law of our State has required their inspection; and we are gratified by some assurances that our farmers are learning to use them judiciously and are getting from them far better results than they formerly obtained.

We are frequently asked which of these fertilizers is the best, and we wish to say here that it is impossible to answer such a question without limitations; because, what is best for one soil and for one crop would not be best on other lands or for other plants. About 100 samples of these fertilizers have been analyzed at our station, and many of the standard articles have been tested on the College Farm. The results have been published in our reports and bulletins which have been sent to all parties applying for them, and to farmers, generally, whose addresses could be obtained by means at our command.

CHEMICAL FERTILIZERS

were tested at the Station for several years without any satisfactory results and that series of experiments was then abandoned. Without reflection, it would seem strange that, these chemicals, the most concentrated form of plant food, and therefore the most inexpensive as to transportation, are not generally used by intelligent farmers; and it would seem that failures result only from the injudicious use of such fertilizers.

It is now very well understood that the food for plants as well as that for animals must contain not only the necessary elements, but it must be properly compounded and prepared before it can be successfully used as food for plants.

Those who deal in commercial fertilizers are trying to meet all demands and it is hoped they may finally succeed.

EXPERIMENTS WITH OATS.

These have been conducted with two main purposes in view ; first, to test rust-proof varieties, and, second, to find or to develop a variety which can resist the cold of our winters and secure to our farmers a reliable fall oat. The best results have been obtained from a variety known here as the "Yellow Rust Proof," and from a very similar variety sold in Tennessee as the "Texas Oat." The promises given by both of these, induce us to recommend them for further trial among the farmers of Tennessee generally.

EXPERIMENTS IN CORN.

To this important crop we have given increased attention.

Our facilities for exact experimentation with this plant are very limited. We hope at no distant day to test the varieties for which we have not had space before. The larger varieties give best results here; but as intimated above, our experiments have been on a limited scale and we have tested only one or two kinds of the Dent and the Flint corn.

We are satisfied that the soil for this cereal should contain a large amount of humus or vegetable matter with which to form it, as fermentation must be quite active during the whole growing season.

This seems to be necessary, not so much on account of the albuminoids, of which no excessive amount is needed by corn ; but from the nature of corn growth, which requires both the warmth generated by chemical action, and the condition of food fresh from the laboratory or hot from the stove of nature's kitchen.

We are inclined to think that this crop has ceased to pay in Tennessee, from a failure of humus in our soil ; and if we will

concentrate our efforts, plant only a small per cent. of the area usually allowed for corn, break the soil very deep, and make it very rich in organic forms, we shall be able not only to compete with Western corn for home consumption, but realize some profits from this crop even in the larger markets.

The immense yields on some of our river bottoms indicate to us what small areas, in a proper condition, would supply our home demand; and when the superior quality of our best varieties here as compared with the Western grain for bread purposes is well understood, as it will be in the near future, we may again hope that corn will prove a remunerative crop.

MISCELLANEOUS CROPS.

SORGHUMS.

A variety of sorghums have, in the past two years, been tested at the Experiment Station for two purposes; first, for silage, and second, for seed. Silage made from the larger varieties of sorghum, such as the "Honduras" and the "Kansas," furnish a silage very little, if any, inferior to that from corn, either in quality or quantity. The results will probably be improved if the seeds from the heavier kinds should be harvested and made into flour to be used with the silage made from the stalks. Thus treated, I am inclined to think it would be superior to corn taken from the same area of land and made into silage after the usual plan.

An improved

MILLO-MAIZE,

maturing in five months or less, will prove a valuable acquisition to the farm, and recent experiments indicate that such an acquisition is now at hand. Our millo-maize matured this year within five months, and we have reports from crops matured in four and one-half months. Two varieties of "Kaffir" corn have been grown at the Station this year. This plant is nearly related to the millo-maize—resembles it very closely, but has less

stalk, branching near the top, bearing larger heads of grain, which is claimed to be far superior to corn for table use, and indeed, for many purposes, very little inferior to wheat. The grain is certainly very fine in appearance, and I should judge from its taste and other qualities, that the smaller and whiter varieties might make superior muffins and batter-cakes. Both of these plants seem to be affected very little by dry weather, being green and flourishing where corn is almost wholly dried up; maturing a second crop of grain now, after six weeks drouth. They seem to promise results more than commonly reliable.

We would recommend that the farmers give these improved Kaffir corns and the millo-maize a fair test, on small areas, during the next season.

COTTON.

A very small area was devoted to cotton the past season, more with the design of testing the quick maturity of certain varieties than with any purpose of recommending it as a crop for this part of the State.

We found one variety, "Taylor's," which grows rapidly, fruits well, and, though planted late, it presented open bolls about the 20th of September.

It is hardly ever safe to recommend a plant from one year's growth; yet, this has given such satisfactory results, that we suggest to the cotton-growers in the western portion of our State to test a few plants of this variety which has been trained to short seasons; it may prove valuable. Our's is a four-celled Taylor.

TOBACCO

was grown at the Station the past season to test only one thing, the capacity of our soil to grow this plant. This experiment indicates very clearly that the soil at our Station will produce tobacco plants of very strong and vigorous growth. The quality of the tobacco seemed to be very good; but we had not the means of curing it properly, or after the most approved plan, hence we can make no exact statement of the quality of the article which may be produced here.

GARDEN PRODUCTS.

Various experiments have been made with potatoes, beets, turnips, cabbage, tomatoes, and other vegetables, to determine the values of new varieties and the methods of treating old ones.

Bulletin No. 7, issued last July, gave some of the results of our work with Irish potatoes to decide whether it is best to use large or small seed, or if the tuber is divided, what sections and what size sections should be preferred.

CLOVER AND GRASSES.

While our work with clover has not given results so exact as we desired, more space and attention have been given to it, and we hope in the future to gather information about the growth and the treatment of this plant, which will decide questions now much discussed among farmers.

Several of the most popular grasses, such as Orchard, Randall and Red-top can now be seen at the Station growing on contiguous plats, and their values for various purposes will be tested as rapidly as possible.

PLANT FEEDING BY GREEN CROPS.

It will not pay to transport barnyard or any heavy organic manures over considerable distances; yet exhausted lands must be reclaimed and the plant food restored to the soil. How to accomplish these results is one of the most important problems ever presented to the practical farmer for solution.

A number of experiments are now progressing at the Station to aid in determining such questions, and in discovering the values of clover, peas, rye and millet, lucerne and other plants in restoring fertility to the soil and in feeding growing crops.

Our work is not sufficiently advanced to authorize positive opinions; but we can safely say that exhausted lands may be reclaimed in a remarkably short space of time by the use of peas and rye.

STOCK FEEDING.

We are probably going, now, beyond the space to which we are fairly entitled in your final report. We are certainly claiming more than we intended when we accepted your kind offer to give us a place in that paper. We will, therefore, venture only a few brief statements under this head.

We feed steers every winter with measured rations of different foods to determine the fattening values of each. The results will be found in our large report which has already been advertised in this publication. We will therefore close this part of our statements with the fact that our best results in cattle-feeding thus far, have been obtained from young animals under three years by using mixed food.

ENSILAGE.

The superiority of this method in the preservation of food for stock can no longer be questioned. It has been so frequently and so thoroughly tested, not only at experiment stations, but by practical farmers, that no one who will examine the facts can longer entertain a reasonable doubt about its being a far more reliable and economical, and also more healthful, than the old methods.

Many of the prominent facts were given in our last full report, as well as some of the most approved methods of constructing silos and filling them. Much of this information was repeated in Bulletin No. 7, as stated above, and those who wish to test the methods can have information from us or from other stations.

THE ANALYSES OF COMMERCIAL FERTILIZERS.

If they owe it nothing else, farmers are certainly under obligations to the Experiment Station for the very great improvement in commercial fertilizers which are now placed upon the

markets of the State. Before these articles were required to be analyzed at the Station, many low grades, and some comparatively worthless brands were sold to the farmers, and public confidence in such goods had been well-nigh destroyed.

The manufacturers of really valuable fertilizers have also been benefited by our work; for not only do the analyses indicate that the articles sold are superior, but we hear during the last seasons few, if any, complaints of failures where commercial fertilizers have been used, and the people are beginning again to employ them in larger quantities, and with greater confidence.

The gathering and compounding of plant food presents one of the most profound and complicated problems in all the science of agriculture. It is to be hoped that the manufacturers of commercial fertilizers are seeking earnestly and honestly to solve this problem. It is very certain that he who presents the most simple and complete solution will richly earn the gratitude of all who engage in agriculture, and will deserve more millions of income than the telephone has brought to its inventor. Our Station is trying to contribute something to this work, which will certainly be accomplished by the busy brains of the future.

GENERAL WORK.

In connection with your Assistant Commissioner, Col. C. W. Charlton, it has been my duty as well as my pleasure, to address the farmers in various sections of the State; and also, by conversation and correspondence, I have consulted with those of other sections.

I am profoundly impressed that this desire for knowledge is stronger than it has ever been among that industrial class; and I am thoroughly convinced that some means ought to be devised for the dissemination of general facts and principles of agriculture among farmers. There are vast resources and influences at their command, but now lying dormant simply for the want of information.

If some one competent to give this information, could be employed as a State lecturer, or instructor, and should be required

to visit every county of the State, to form associations, encourage the people to seek knowledge and to hold institutes as frequently as possible, I feel sure that the money required for his salary and expenses would yield a larger income to our State, to say nothing of its benefit to our people, than any investment that could be made of an equal amount. This suggestion is not an untried theory, for a plan somewhat similar has been employed with great success in Minnesota and elsewhere.

Let our system of agriculture be improved, let the barren places be made fertile and covered with grass, then the inspecting immigrant will stop a moment; capital will be invested here in large amounts; our immense but dormant resources will be aroused and developed; our treasuries will be filled and taxes reduced, and peace and plenty will reign in this smiling land.

In closing this report, please allow me to express to you my obligations to Col. Charlton, who has so kindly introduced me to the people in many places. He is a veteran worker, full of an earnest love for agriculture; he has done more than any other man to encourage and sustain the farmers of East Tennessee at all times, and especially in seasons of depression; hence, having their confidence, his indorsement always opened to me not only the ears, but the hearts of the people.

Respectfully submitted,

JOHN W. GLENN,

Prof. Agr. Univ. of Tenn., and D. E. S.

BULLETIN No. 7.

ENSILAGE;

A SYSTEM GIVING THREE OR FOUR TIMES AS MUCH STOCK FOOD TO ONE ACRE AS THE OLD METHODS.

As we are now in the midst of the season for planting silage corn, I recommend that the farmers of Tennessee test a system which has hitherto given good results.

From the latter portion of this paper, it will be seen that, almost without exception, those of us who have tried ensilage approve the plan, and many are almost extravagant in their terms of commendation.

To all stock breeders it promises a large reduction of expenses, and to those who feed cattle for the dairy or the shambles, it brings the chance of some profits even at the present low prices. The corn for silage may be planted any time from the 15th of April to the 1st of June. It may even be planted about the 1st of July after a wheat crop has been removed from the ground, as several times it has been done at the College Farm.

The large varieties of sorghum make good silage, but we prefer Indian corn, or maize. The rows should be made about three or four feet apart and the corn sown thick in the rows; and it should be cultivated until it is almost ready to tassel, or is, at least, large enough to keep down all other vegetation. It should not be so thick as to produce no ears at all, but much more crowded than when planted for grain.

We have tried broadcasting, but find the results not near so good as those from rows. When the corn is in the roasting ear state, the stalks should be cut with large knives and carried to

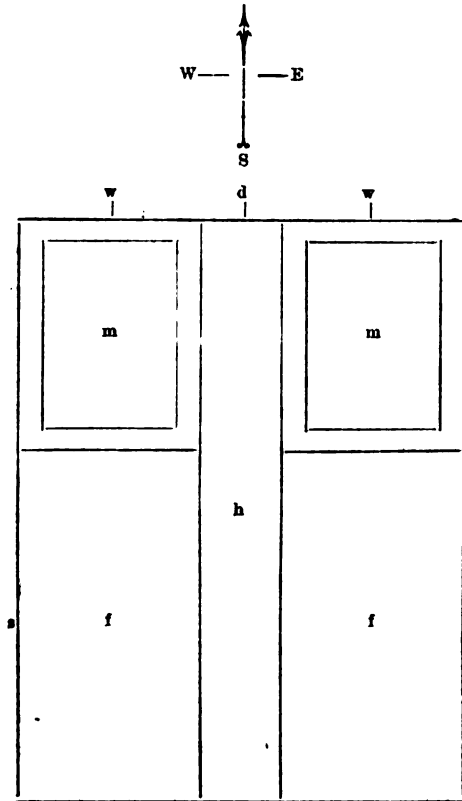
the silos, where the strongest of feed cutters must be used for chopping it up into sections of three-fourths of an inch, which are passed to the silos, distributed evenly into all parts and tramped thoroughly and constantly as the filling progresses. No salt or soda is needed, as the silage is not thereby improved in any respect according to our experiments. After the silos are entirely filled, or according to desire, let the silage be covered over with planks, making the covering narrow and short enough to pass down into the silo as the food yields and the weights sink. Then place dirt on the planks to the depth of twelve or eighteen inches, or if large rocks are at hand they may be used, or any other heavy and convenient weight.

The silos should be made of a size corresponding with the demands; allowing twenty-five or thirty pounds of silage per day for each head of neat cattle and remembering that a silo twenty feet long, ten feet broad and ten feet deep, will hold near sixty tons. The silo or pit should be, if possible, perfectly water tight and protected from the weather above. It is considered the cheapest to dig them in the ground—say in the side of a hill—and line them with brick, laid in hydraulic cement; yet many of the best are now constructed entirely of stone or of logs, either entirely or partly above the ground. From these last it is much more convenient to remove the silage when needed for consumption. A pen made of logs well dovetailed together, then lined or cemented so as to make it air-tight, can probably be made very conveniently and economically. Ours at the State Experiment Station are constructed under the main floor of the barn, front end, and extending down to the floor of the basement under the rear end of the barn, where, and under sheds on the same level, are constructed stalls for the cattle.

It is hardly possible to give exact ideas about the silos without engravings; but the ground plan herewith presented, may aid the reader to understand the plan, or may help him to form one suited to his own location or convenience.

The barn at the Station was built on a southern slope with the front end to the north; the back end is, therefore, about ten feet above the surface of the ground. Just under the front end of the building, one on each side of the hall, are located

the silos; then beginning about a foot back of the silos the earth is all excavated under the barn, thus forming under the middle and rear portion a large and comfortable basement for cattle stalls. From this basement, leading into each silo, is a small door by which the silage can be extracted and conveyed to the stalls.



GROUND PLAN OF BARN JUST OVER STALLS AND SILOS.

d, Front entrance. h, Hall. m, m, Silos. f, f, Floor just over stalls. s, s, Sheds over stalls.
w, w, Window above mouth of each Silo.

Below will be found a statement of the facts and reasons on which are based the above suggestions and recommendations to the farmers of Tennessee.

All scientific and carefully conducted experiments have thus far encouraged the use of silage, with the single exception of a few tests made last year at Woburn, where the silage was not properly or judiciously used, as will appear below.

For five or six years past, I have been testing or examining this method of preserving food with considerable interest and care, and to save the farmers of Tennessee from throwing away their money on useless and unprofitable experiments the silos were constructed, and the system examined critically at the College Farm.

Not only have the results of our own experiments been given to the public year after year, but my last report contains the testimony from a number of experiments from different parts of Europe and portions of the United States. While I would not, if I knew it, induce any farmer to engage in any enterprise which would be unprofitable, I have always encouraged them to test new methods, if there was good reason to believe them improvements on the older ones; especially in cases where there was no great risk.

If more thorough tests shall prove that the system is not worthy of general adoption, my position demands that I warn the farmers against it, and if there should be any need of caution in the further development of the system, I shall not hesitate to give it, as I have already done in my last report with reference to feeding it to horses or mules; or feeding to cattle without a small admixture of hay or other dry food. I do not recommend it as a perfect food for cattle without hay, so I would not recommend meal or roots without hay or long forage as a perfect food for cattle. The only experiments which seem to discount were conducted at Woburn, and as showing that silage alone is not equal to hay and roots in fattening value, correspond exactly with my own experience and observations. But these experiments were canceled by experiments which the Highland Agricultural Society made. In these last tests some hay or other long forage was used with the silage as well as the roots. These last results correspond also with my experience and observations. I have always insisted that the silage should be mixed with a small portion (1-6 to 1-5) of

chopped hay. In this way it is a perfect substitute for the roots and a large portion of the hay, and it seems to be a great deal cheaper, both in production and in preservation. The silo for keeping the silage need cost very little, certainly not more than a cellar for the keeping of roots properly.

Where the clay is stiff, a simple hole in the ground with a shelter over it and a trench around it for draining is all that is absolutely necessary. A log pen has been used successfully where the silage was weighted with stones, and cases are reported where the green corn was piled on a flat rock, weighted with heavy stones and thus preserved without inclosing walls; but of course I would not recommend such methods. I only mention them to show how unnecessary are great expenditures in this process of preserving the food.

Now as to the production: Meadows which will produce two tons of hay per acre, will produce from twenty to twenty-four tons of silage or, at the least, ten to one. In the production of meat or milk one pound of hay is equal to two, or two and one-half pounds of silage. Taking the larger number, we find that the silage from one acre is, at least, four times as much as the hay from the same land. The cost of preserving the two products from the same area would be about equal. If we take into consideration the chances of loss from uncertainties of weather, the balance is still increased in favor of the silage system; for the silage can be cut and stored safely in any kind of weather. Again, the silage, pound for pound, is worth three times as much as turnips in the production of meat or milk, and one acre will produce from two to three times as many tons, hence, the production from one acre is six to nine times as great; and it may be added that its superiority over the potato is very little less. The above estimates are made from tables and results obtained as the average of very many tests carefully made, and in every instance the margins of doubt or variations have been placed against silage. Here then is a method which promises as much cattle-food from one acre as has formerly been gathered from four and even seven acres. This is better even than "causing two blades of grass to grow where only one grew before." No farmer can hesitate to adopt

such a method, provided it can be shown that no evils result to the cattle which feed on the silage, or to people who consume the milk and meat; for the question can hardly be raised now as to the comparative amount of cattle-food gathered from an acre of silage, or as to the comparative amount of milk and meat produced by said silage.

Let it be kept in mind that one acre in silage will produce *four times as much milk or meat* as the same acre in hay, and about EIGHT TIMES AS MUCH AS THE SAME acre in turnips. The first experiments with a view to utilizing silage as a food were made about thirty-five years since by a Frenchman, M. Goffart. Since then the system has been carefully tested at many experiment stations, by hundreds of scientists and by thousands of farmers, and I cannot now recall a single well-authenticated instance of harm resulting to cattle from eating silage. Evil may have come from the use in excess of this food alone, as may result from any other forage; but altogether, it seems to be as innocent as any other food given to cows or beef cattle. I have before me the latest reports from many of the States, and also from Europe. From my last report I give some testimony from England.

Of thirty-six farmers sixteen commend ensilage (silage) as a butter and milk producer.

Nineteen say that it kept stock in good condition, and is good for fattening animals.

Seven mention its economy, particularly.

Six think it an excellent substitute for roots.

One does not approve, for milk and butter.

One does not think it wholesome for stock when fed alone.

Five approve highly, without giving special reasons.

From the same report I give the following testimony from our own country:

A committee from the Essex (Mass.) Agricultural Society made a careful investigation, by correspondence, of the experience of those who have tried ensilage, and reached the following conclusions:

1. That ensilage (silage) is a nutritious and profitable feed for all kinds of farm stock, but especially adapted to milk cows.

2. That the flavor of the milk and butter is not much different from that made from summer green feed, but is more uniform.

3. There is invariably an increase of flesh and flow of milk when the same amount of grain is fed with it as with English hay.

They also say that it is not only healthy food, but it improves the quality of the beef.

The above resolutions were copied and approved by the *Southern Cultivator*, the highest authority in all the South.

These are strong indorsements, but we have others later and higher, and I am very sorry that I have not the space to give them all and in their own language. I condense and give a few :

First—Many of the State experiment stations, North and South, have been testing silage, and they indorse it as healthful, nutritious and economical. Some of the strongest indorsements come from such stations as those of New York, Michigan, Tennessee and Mississippi.

Second—At the Ensilage Congress held in New York City, in January, 1885, not a voice was heard to doubt the healthfulness or value of silage.

Correspondence with that body was invited, and letters came from almost every portion of the Union, and, as I remember, all the correspondents approved the system. Charges against the healthfulness or utility of silage were investigated with some care and it was found that this food had been given freely to almost every kind of stock, and it was ascertained that where harm was done to cattle, or even mules, it came from spoiled or decayed silage. The complaints against silage as impairing the flavor of butter and milk were also examined, and it was stated that where there was any real foundation for such complaints, the taint came from the use of cotton-seed, oil-

cake, slops or decayed peas—or possibly decayed silage. It was also declared that neither the health nor potency of animals was ever impaired by silage unless it was partially decayed.

At the last meeting of the same association, held in New York about the last of January, 1886, after another year of trial and investigation, confidence in this method of preserving stock food was re-affirmed in stronger terms than any ever used before; and the Secretary writes me that the convictions are so unanimous in its favor that "not a sufficient amount of question or doubt could be raised to even give zest to the discussions on that subject."

Third—We have it from some of the highest authorities in science, such as the physiologist, T. S. Lambert, LL.D., and the chemists of the Royal Society in England and several others, that the corn is much improved by "ensilaging;" that it is rendered far more digestible and more of it is assimilated. Indeed Dr. Lambert says that the chemical changes in the silo are almost identical with those which take place in the stomach of the cow during the first stages of digestion and the cow is therefore relieved of that part of the labor of digestion. They all agree that this food is most healthful.

Fourth and last—Drs. Lawes and Gilbert, of Rothamsted Farm, England, are generally known in Europe and America as among the ablest, safest and most cautious experimenters in the field of science; and they have been apparently very reluctant to even investigate the virtues of the ensilage system—unusually so for them. But they finally consented to make some experiments and they have this season declared very frankly that silage is a healthful and nutritious food. Do we need any higher authority than these to induce us to experiment in food which seems to give such general satisfaction and which quadruples the milk and meat from one acre? I, myself, have based my recommendations and opinions on authority higher than all the above, and that is personal experience and observation at the College Farm. The results of my experiments, together with my opinions, were published in my last report. They can-

not be given in this Bulletin which is now much longer than I intended to make it. I would only say that we have been feeding silage at the College Farm for nearly six years, and so far as I can decide, none of our cattle have ever suffered from it in health or in strength of constitution; besides it has increased vastly the amount of stock food from the same area of land.

I think a system which promises so much and is so well indorsed is worth a trial in every county by some one able to make it.

Parties interested will please ask for my report. I also refer them to the last report of the Royal Agricultural Society of England, to the last report of the Ensilage Congress and reports from the State experiment stations.

JOHN W. GLENN,

Director Experiment Station.

Average Results from Eight Sets of Experiments Running through Four Seasons.

Steers	Average Daily Ration for Every 1,000 lbs. Live-weight.	Gain per Day.	Gain per Month.
8	20 lbs. good hay gave about-----	1.28 lbs.	38.40 lbs.
8*	25 lbs. Silage (corn) gave about-----	1.62 "	48.60 "
6	30 lbs. Silage and 5 lbs. hay gave about-----	1.95 "	58.50 "
6	35 lbs. Silage and 8 lbs. hay gave about-----	2.05 "	61.50 "
6 lbs. Corn Meal added to any ration gave about 24 per cent. increase.			
6 lbs. Corn Meal Cake added to any ration gave about 32 per cent. increase.			

NOTE.—From the above exhibit it is safe to assume that

2½ lbs. silage equal 1 lb. hay in production of meat.

1 acre silage equal 10 acres hay by weight.

1 acre silage in meat value is four times as great as hay.

TABLE—Showing Comparative Results from Silage and Hay in Milk and Butter.

Short-horn, on hay, made 14 oz. butter from 15 pints of milk.						
Devon, " " " 13½ " " " 15 " "						
Devon, on silage " 11½ " " " 15 " "						
Short-horn " " 12½ " " " 15 " "						

During the whole period the milk of each cow was carefully measured, then churned and the butter weighed. Each cow, while eating the silage, gave more milk by about 18 per cent.; but as will be seen by the above table, the milk did not make as large a proportion of butter.

* Many steers, at first, refuse to eat silage alone, others are made sick for a time; so the above is probably a full average result from all subjects fed on silage. Better use a little hay, though some of the other lots were also sick.

SUGGESTION TO FARMERS.

Farmers are advised not to buy any fertilizer unless it has both the manufacturer's guaranteed analysis and the Inspector's tag upon or attached to it; and all farmers are requested to inform the Commissioner of Agriculture of any case where a fertilizer is sold, or offered for sale, without having both the guaranteed analysis and the Inspector's tag attached.

Prof. John W. Glenn, Director of the Experiment Station, University of Tennessee, having suggested "It may be well to say there is some difference of opinion as to what constitutes *available acid*, and it will not be wise to condemn harshly when there is a large *total acid*, even if the *available* be considerably below the standard."

I have examined the report contained herein of the analyses of twelve fertilizers mentioned from "13h" to "24h," inclusive, and respectfully approve the same, and hereby order that they be published by and at the expense of the Experiment Station for distribution.

A. J. McWHIRTER,

Commissioner.

Analyses of Fertilizers from 13h to 24h, inclusive.

MANUFACTURER OR AGENT.	LOCATION.	NAME.	No.	Mixture.	PHOSPHORIC ACID.			Ammo- nia.	Potash.	Value.
					Insol.	Avail.	Total.			
Chemical Co., Canton	Baltimore, Md.	Dissolved S. C. Bone	13h	15.25	2.83	12.75	15.58	---	---	\$30.600
Chemical Co., Canton	Baltimore, Md.	Baker's Standard Guano	14h	13.24	4.69	7.79	12.48	2.05	2.64	31.704
Chemical Co., Canton	Baltimore, Md.	Soluble Alkaline Bone Phosphate	15h	13.45	6.62	6.78	13.40	---	2.40	27.096
Travers, Sneed & Co.	Richmond, Va.	Orchilla Guano	16h	8.60	13.76	4.66	18.42	---	35	28.116
Southern Fertiliz'g Co.	Richmond, Va.	A. B. for Tobacco	17h	13.26	7.42	5.86	13.28	2.99	1.33	30.012
Southern Fertiliz'g Co.	Richmond, Va.	A. B. for Wheat	18h	13.95	6.98	5.83	12.81	2.17	1.98	26.784
Southern Fertiliz'g Co.	Richmond, Va.	B. P. Potash Mixture	19h	5.08	17.28	1.51	18.79	---	3.53	28.596
Scholze Bros.	Chattanooga, Tenn.	Pure Dissolved Bone Meal	20h	16.07	3.23	7.81	11.04	2.38	2.10	32.688
Adair Bros. & Co., Agts	Atlanta, Ga.	Soluble Pacific Guano	21h	18.54	4.26	7.68	11.94	1.79	1.34	28.632
Zell Guano Co.	Baltimore, Md.	Economizer	22h	14.31	2.28	10.39	12.58	1.44	1.56	33.504
Davie & Whittle	Petersburg, Va.	Owl Brand Guano	23h	17.13	2.38	9.05	11.43	1.95	1.76	33.192
Davie & Whittle	Petersburg, Va.	Owl Brand Tobacco	24h	13.31	2.83	8.83	11.66	2.65	2.32	36.696

NOTE.—In making the above estimates, the values assigned to the chemicals are purely relative, and are as follows:

Available phosphoric acid, 12c. per lb.; ammonia 24c. per lb.; potash, 6c. per lb. The value of fertilizer is estimated thus:

No. 14h, available phosphoric acid, 7.79; multiplied by 20 cwt. in ton, multiplied by 12c., price per lb., equal value, \$18.696

No. 14h, ammonia 2.05; multiplied by 20 cwt. in ton, multiplied by 24c., price per lb., equal value, 9.840

No. 14h, potash 2.64; multiplied by 20 cwt. in ton, multiplied by 6c., price per lb., equal value, 3.168

-----\$31.704

By the law of Tennessee no value is assigned to insoluble phosphoric acid, but it is generally considered to be worth one-fourth to one-third as much as the soluble. Costs of manufacturing, sacking and transporting not reckoned here. In valuing Nos. 15h and 16h the insoluble phosphate was added at half price; as it is probably quite soluble in the soil acids and both brands contain valuable alkaline salts.

JOHN W. GLENN, *Director State Experiment Station, University of Tennessee.*

W. E. MONES, *Chemist.*

BULLETIN No. 8.

POTATO SEEDING.

In the discussions of potato culture much has been written about the selection and preparation of the seed. Some insist that large, uncut tubers should be used; claiming that they produce more vigorous plants. This is a popular theory in Germany. On the other hand it is said that large tubers "run too much to vine," and are late producing new potatoes. Others declare that even small potatoes should be cut, especially for the second crop, because the cut tuber sprouts and grows off more promptly, and the whole potato, if planted in August, is apt to lie without sprouting until next spring. Various opinions also obtain as to the manner and extent of cutting, and as to which portion of the potato will produce the largest crop.

Many insist strenuously that at least two eyes should be left on each section of the potato, and that only the seed end of the potato should be used. At the Experiment Station it is proposed to conduct a series of experiments to decide, if possible, these disputed questions, though we are inclined to think that the soil, season and variety may prove more important factors than the size or section of the tubers. Below will be found results from the first set of these experiments. The land was thoroughly broken and a well rotted compost used in the drill. The rows were about thirty-four inches apart, the potatoes were placed along the drill at a distance of ten or twelve inches, and the crop was cultivated in the usual manner. The seed were planted April 2, and the new potatoes dug August 13, 1885. The rows extended across the field through soil as nearly equal in fertility as could be secured.

No.	VARIETIES.	CONDITION OF SEED.	YIELD IN BUSHELS.	
			Lge. Tubers.	Sm. Tubers.
1.	Burbank-----	Cut to one eye-----	257	
2.	Beauty of Hebron----	" " " " -----	201½	4
3.	" " " -----	Half "seed end"-----	104	50
4.	" " " -----	" "butt end"-----	60	56
5.	" " " -----	Whole, medium size----	217	5

Analyses of Fertilizers from 25h to 36h, inclusive.

MANUFACTURER OR AGENT.	LOCATION.	NAME.	No.	Moisture	PHOSPHORIC ACID.			Ammonia.	Potash.	Value.
					Insol.	Avail.	Total.			
Memphis Fertilizer Co.	Memphis, Tenn.	Ammoniated Phosphate.	25h	9.87	3.07	9.99	13.06	1.35	3.26	\$34.352
C. & F. Singer	Nashville, Tenn.	Pure Raw Bone.	26h	* 9.04	18.73	3.62	22.35	4.34	14	29.698
S. W. Travers & Co.	Richmond, Va.	National Tobacco Fertilizer.	27h	8.17	4.14	7.44	11.58	2.18	3.14	32.083
Symington Bros. & Co.	Baltimore, Md.	Symington's Bone and Potash.	28h	14.39	2.45	10.08	12.53	---	2.11	26.724
Symington Bros. & Co.	Baltimore, Md.	Ammoniated Bone.	29h	14.14	1.30	10.33	11.63	1.56	2.01	34.692
Dambmann Bros. & Co.	Baltimore, Md.	Wheat, Corn and Oat Fertilizer.	30h	12.78	.33	9.18	9.51	2.05	2.32	34.652
N. W. Fertilizing Co.	Chicago, Ill.	Tobacco Compound.	31h	11.37	3.90	7.96	11.86	4.11	24	39.050
Slingluff & Co.	Baltimore, Md.	Ammoniated Bone.	32h	12.44	1.78	8.27	10.05	2.20	1.93	32.720
Slingluff & Co.	Baltimore, Md.	Acid Phosphate.	33h	15.21	3.55	12.01	15.56	---	---	28.820
Slingluff & Co.	Baltimore, Md.	Dissolved Bone.	34h	13.83	3.45	9.04	12.49	66	1.80	26.976
Michigan Carbon Wks	Detroit, Mich.	Homestead Tobacco Grower.	35h	5.66	.91	8.04	8.95	5.51	5.96	52.896
Michigan Carbon Wks	Detroit, Mich.	Homestead, Corn and Wheat Grower	36h	5.46	.97	10.96	11.93	4.42	21	47.772

NOTE.—In making the above estimates, the values assigned to the chemicals are not real, but purely relative, and are as follows:

Available phosphoric acid, 12c. per lb.; ammonia, 24c. per lb.; potash, 6c. per lb. The value of a fertilizer is estimated thus:

No. 25h, available phosphoric acid, 9.99; multiplied by 20 cwt. in ton, multiplied by 12c., price per lb., equal value, \$23.976

No. 25h, ammonia----- 1.35; multiplied by 20 cwt. in ton, multiplied by 24c., price per lb., equal value, 6.480

No. 25h, potash----- 3.20; multiplied by 20 cwt. in ton, multiplied by 6c., price per lb., equal value, 3.912

* No. 26, an excellent specimen of bone, is too coarse to furnish much available acid under the usual treatment. By the law of

Tennessee no value is assigned to insoluble phosphoric acid, but it is generally considered to be worth one-fourth to one-third as much

as the soluble. Costs of manufacturing, sacking and transporting not reckoned here,

JOHN W. GLENN, *Director State Experiment Station, University of Tennessee.*

W. E. MOSES, *Chemist.*

REPORT
—OF—
C. W. CHARLTON,

ASSISTANT COMMISSIONER FOR EAST TENNESSEE.

1885-86.

REPORT.

HON. A. J. McWHIRTER, *Commissioner of Agriculture, Statistics,
Mines and Immigration:*

DEAR SIR—On the 19th of June, 1885, I had the honor of receiving at your hands a commission, clothing me with authority to act as Assistant Commissioner of Agriculture, etc., and directing me to use proper diligence in pushing forward and stimulating the agricultural interests of Tennessee; of bringing about, if possible, effective methods of restoring exhausted soils; of attracting capital and population—in short, to leave no stone unturned in carrying forward the object and aims of the Bureau which you represent, and which you have so intelligently and effectively sustained for the last four years.

At the threshold of this report, allow me to say, that the policy you adopted in designating two assistants in the two grand divisions of the State to co-operate with you in the prosecution of the work of the Bureau, was conceived in a broad conception of its importance to the different sections of the State. In making this departure you did the fullest justice to all sections of the State alike, leaving no grounds of complaint of unfairness or partiality on your part. Consequently, your administration has met the hearty approval of your fellow-citizens, irrespective of party, who feel that you have not only complied with the letter of the law governing the Bureau, but that you have achieved wholesome results to the State; results that will become apparent as they are developed in your final report, and that the money set apart for its maintenance has been judiciously expended.

Immediately on the receipt of my commission, I proceeded to organize my work by first spreading out, over East Tennessee, a list of appointments for the purpose of bringing as many

of the farmers together as possible in order to address them, and thus to create a more lively interest in agricultural pursuits; not to dictate to them, or to tell them what I know about farming, but rather to confer with them and to seek their co-operation in a well-meant effort to adopt such methods and appliances as would tend to restore our lands to their normal condition; in other words, to stimulate healthful thought and arouse energy and action in the prosecution of the work in which they were engaged.

This, your Assistant regarded as paramount, and that to make East Tennessee what it ought to be, and what it was competent to achieve, her own people should appreciate the necessity of depending more upon themselves and less upon foreign succor; that they should realize that their success hinged upon their individual efforts more than upon anything else. Important as immigration is conceded to be, it is not an infallible cure-all of the ills that afflict agriculture. As an adjunct, it is needed, and should be sought by all legitimate means, but it is more creditable to our manhood to take care of ourselves. We should never ask strangers to do for us what we ought to do for ourselves. It is well enough, of course, to secure them if we can. Let them come. Invite them to come, but, until then, work and manage as if everything depended upon our own exertions. That is one way to get them, in fact. If we will improve our lands and bring them up to a higher state of cultivation; if we will adorn and beautify our homes and make them attractive; if we will construct better roads, so as to make transportation easier and more profitable, and if we will encourage and foster education, there will be but little trouble, comparatively, to swell the tide of capital and population toward our section.

Actuated by these convictions, I appealed to the farmers to do their utmost to raise the standard of agricultural reform, to improve their lands by every possible method and appliance, to form farmers' clubs and farmers' institutes for the purpose of discussing questions of importance to themselves, and in this way to make East Tennessee the garden spot of the Union.

A large measure of influence in this direction was the result of the East Tennessee Farmers' Convention, organized more than fifteen years ago at the instance of Chancellor Temple and myself. It has been a power among the farmers of this section. It inaugurated a new era and stirred the agricultural mind as it was never before stirred. It brought representative farmers to the front, whose influence and intelligence was needed to advance the cause of agriculture. Advanced methods were thus developed and broader conceptions of the dignity and value of farm-life was realized. Of course its progress was necessarily slow. Old ideas cannot be dislodged in a day or a year. They are, however, giving way to the timely efforts of this institution, and more enlightened ones are taking their places. Grass, the bulwark of agricultural advancement, is taking the place of corn; and cattle, mules, and horses the place of hogs. The hog for half a century or more reigned supreme, he was emphatically master of the situation and did his work of destruction effectually; lands, originally fertile, succumbed to his murderous rule and ceased to remunerate their owners for their labor and expenditures. The conclusion has been reached that he must subside as a factor of prosperity and that grass must be enthroned as the chief hope of repairing the damage he has done.

I would be untrue to the history of facts were I to be silent as to the active part you have taken in bringing about this result. I refer, if you please, to your reproducing the great work on the grasses, which has awakened such a marvelous interest in the cultivation of the grasses, hundreds of copies of which you sent to this office, were remailed and forwarded to the addresses of a class of farmers who would use them to advantage. The result is, a vast increase of acreage in the production of grass, and a corresponding increase of horses, mules, and cattle. A carefully compiled statement of the shipments of cattle, and of those supplying the home demand would show a large increase over former years, and a decided improvement in their quality. There is, too, a gradual and steady introduction of better improved breeds, such as the Short-horns, Holsteins, Jerseys and Devonshires. These, meantime, are being crossed on our native cattle, producing good grades.

The improvement in horse stock is striking. A number of enterprising gentlemen have expended considerable sums of money in the purchase of Percheron, Clydesdale and Morgan stallions. In this respect our section of the State is attracting attention. Large sales have been made to buyers from Pennsylvania and other markets, and a notable increase will be realized in the near future.

East Tennessee is destined to perform a conspicuous part in stock raising, possessing, as she does, a climate and soil admirably adapted to the business. Nothing but the stolid indifference on the part of the farmers can prevent it. East Tennessee is emphatically a grass producing country and, therefore, must necessarily become an important factor in the stock raising business. It will produce all the grasses, such as timothy, orchard grass, clover and herd's-grass.

In this connection allow me to invite your attention to the subject of fairs in East Tennessee, confessedly of paramount importance in building up and sustaining a prosperous agricultural future. There are not as many as should be. There is considerable room for many more. There are but six, when there should be one in each county, in view of their recognized importance.

The Eastern Division Fair, established before the war and partially sustained by legislative aid, is not in existence. It was revived after the war, and for a few years was a success. It finally fell to pieces, inflicting serious damage on our agricultural interests. The State had donated some fifty acres of land near the city of Knoxville for fair purposes, and still owns it, subject to the control of any responsible organization that will take charge of it, put the grounds in order, erect new buildings and hold annual fairs.

A joint stock company was formed two years ago with capital enough to run it, but owing to some lameness in the action of the Legislature in conferring certain rights and privileges, a failure was the result. Another attempt, I am informed, will be made at the approaching session of that body to formulate and secure the passage of another act entirely satisfactory, in

which event the company will raise \$20,000 with which to equip the concern and put it to work on a sound and permanent basis. The gentlemen forming the association have ample means at their command and comprise the best element of the city. The grounds are eligibly located, and now reached by a street railway.

The Border Fair, located near Bristol, was organized several years ago. It is in the midst of a productive region, surrounded by a good class of farmers, and has a promising future before it. Its annual gatherings have always been a success, both in its exhibits and in its financial returns. Its officers, from year to year, have been efficient, doing what they could to make it useful to the country adjacent. Bristol, near which it is located, is a pushing and prosperous young city, numbering some 3,000 inhabitants, and noted for the enterprising character of its citizens.

Some years ago Washington County organized a fair under the most encouraging auspices, and, for a considerable length of time, gave evidences of unusual prosperity. It was ably managed, and every succeeding fair not only met all its obligations, but with a surplus in its treasury. This season it suspended, much to the surprise of the people who had taken such an active part in sustaining its fortunes. It is not dead, however. The business men of Jonesboro and the enterprising farmers of the county will not allow it to fail.

The Greene County Fair, situated near the town of Greeneville, long ago established, has never faltered or staggered in the prosecution of its work. Its annual gatherings have been attended with eminent success. No one doubts its permanency, while its beneficent results have been most gratifying. The late fair held there in September was a complete success.

A few years since an enterprising farmer from Illinois by the name of Watkins, settled in Blount County. He found it without a fair. He took the matter in hand, and through his untiring efforts succeeded in organizing one. Several were held with satisfactory results. For the want, however, of sufficient co-operation, it finally went down, and that, too, in one of the best counties of East Tennessee.

Loudon County held its maiden fair this season. Though gotten up hurriedly, it was, nevertheless, a splendid success. It is near the town of Loudon, a flourishing town on the Tennessee River, and surrounded by wealthy farmers and productive farms.

Perhaps one of the most successful fairs in East Tennessee is the Monroe County Fair, organized some years ago through the efforts, mainly, of Col. H. B. Yearwood. It is located at Sweetwater, in the heart of the finest agricultural section of this division of the State, noted for its splendid lands and its excellent farmers. There has never been a drawback to it. Its annual fairs have always been a success. The last one was every way creditable. It is out of debt, and the grounds are ample and well improved. I would not be invidious when I say that a large share of its success has been due to the indomitable energy of Col. H. B. Yearwood, the originator and founder of the "*East Tennessee Stock Breeders' Association*," which is doing so much to create and perpetuate a pure-bred race of animals.

For a number of years Rhea County has been signally favored with an efficient fair. It has, at no time, lost its hold on the farmers of that section. Its annual displays of stock, etc., have been above the average, and its receipts more than equal to its premiums and expenses.

Chestnut Grove Fair is located in Jefferson County, and in a quiet, unostentatious way has done much toward promoting the agricultural interests of that county.

In the fall of 1885, including the months of September and October, agreeably to your instructions, I visited Northern Ohio and Northwestern Pennsylvania, where I was cordially received. I found myself among a large-hearted, intelligent and progressive people, with advanced ideas on all questions, and especially on the subject of an advanced agriculture, as the splendid condition of their farms attested, with their luxuriant grass, superb stock, comfortable homes and capacious barns. I reached that grand section just in time to attend a number of fairs, then in full blast, and had the pleasure and honor of addressing large and attentive crowds, who seemed eager to hear

all that could be said about Tennessee, her resources, climate, etc., not failing in the meantime to scatter abroad hundreds of documents furnished by the Bureau, setting forth the advantages of our section.

Your Assistant is not without evidence that his visit there produced gratifying results, and was impressed with the fact that much is to be gained in the interest of immigration by such visits. I had the opportunity of seeing the people eye to eye; of talking with them in person, and answering questions, which poured in on me without stint. On my return scores of inquiring letters followed me, and intense interest was manifested in our section. Following these came a number of families, composed of farmers, business and professional men, laborers and mechanics. They are here, permanently settled, and identified with us in stimulating industry and in building up the country. In due time many more will come. Those already here are aiding and pushing forward the work of immigration by writing back to their friends and neighbors and persuading them to come here.

Your Assistant was so thoroughly impressed with the valuable results of such an influence that he conceived the idea of forming, out of Northern resident citizens, a "Northern Citizens' Immigration Association," which would throw its influence into the scale of inducing capital and population into our midst. It was organized without difficulty, and its first step was to get up a somewhat exhaustive report of soil, productions, climate, mineral resources, education, etc. Ten thousand copies of it were issued, which have found their way into all the States north of the Ohio River, and to-day are accomplishing vital results in our behalf.

Subsequently the Association, through its able President, Dr. J. M. Masters, issued a call for a convention of Northern resident citizens from all parts of East Tennessee. It was largely attended, and the liveliest interest was shown in its objects and aims. Representative and intelligent men were in attendance, and the discussions embraced a wide field of thought. It is a permanent organization, and holds its meetings annually.

Through its influence we are hopeful of important results in our efforts to bring population to this division of the State.

The work of immigration has gone on steadily here for years past, but has benefited our towns and cities more than the rural districts, though the latter have received considerable acquisitions to them of efficient farmers. Chattanooga, Knoxville, Cleveland, Athens, Loudon, Greeneville, Maryville, Bristol, etc., have been especially benefited, while the counties of Hamilton, Bradley, McMinn, Blount, Anderson, Jefferson, Hamblen, Greene, Morgan, Scott, Loudon and Roane have received the largest accessions of farmers.

Perhaps 85 per cent. of the population of Chattanooga is made up of Northern citizens, and 90 per cent. of its capital furnished by the same class. Its immense manufacturing interests, its forge hammers, its smoking furnaces, its fabulous out-put of coal and iron, and its outstretching lumber trade, have been built up by Northern capital and enterprise. Their investments will run far up into the millions.

Cleveland, a neighboring young city, and one of the handsomest and most attractive of its size in East Tennessee, has been largely benefited from the same source. It is rapidly taking on the proportions of a prosperous city, with its splendid school system and its enterprising citizens.

As to the city of Knoxville, no one familiar with its history in the last few years can call in question the salutary effects of Northern capital and population upon its present commercial and manufacturing status and its future destiny. In the last decade it has grown from a population of some 20,000 to upward of 30,000. Its progress has been phenomenal, its increase of commerce unprecedented and its manufacturing interests greatly multiplied. Its rolling mills, its cotton factories, its foundries and machine shops, its car wheel industry, its car factory, and its furniture, wagon, buggy and carriage factories have been largely sustained and built up by Northern capital.

Recently more than a million of dollars of Northern means have been invested in coal and mineral lands. The Scottish Land Company have bought more than 40,000 acres of timber

lands in our mountains, which it is now utilizing. It has established a mammoth saw mill plant near the city of Knoxville, building booms and preparing for an immense trade in the lumber business. In the counties of Unicoi, Carter, Johnson, Blount, Sevier, Monroe, Morgan, Scott and Anderson, half a million of acres of similar lands have passed into the hands of Northern capitalists.

But Northern capital has not stopped here. It has entered largely into the grand work of fostering our educational interests. More than a million of dollars is invested in the Vanderbilt University; half a million or more in the Chattanooga University; a large sum in the Grant University at Athens; several thousand dollars in Maryville College, Blount County; and something like a hundred thousand or more in Knoxville College, an institution intended specially for the education of colored people. In the city of Knoxville, through the untiring and philanthropic efforts of a Northern lady (Miss Austin), an industrial school has been established for the education of colored boys and girls, the boys to learn trades and the girls domestic duties.

Tennessee is just beginning, through the agency of your Bureau, to attract attention. Has your work in this direction proved an abortion? Did your unflagging efforts to give Tennessee a name and a place in the Louisville and New Orleans expositions result in a failure? Can this be believed in the face of the thousands from all parts of the Union who, for days, weeks, and even months, had their attention called to its varied productions and resources? Surely there cannot be a reasonable citizen of the State who is disposed to make light of that exhibit? Be that as it may, the result has been a grand one to the State.

What has East Tennessee gained by thus advertising her advantages? Much every way. She has gained millions of dollars of capital invested in coal, iron, timber, zinc, farming lands and manufacturing enterprises. She has gained a large increase in population, distributed here and there in the different counties and towns, and each new-comer bringing with him from three hundred to five hundred dollars. She has gained in

all branches of commerce and industry. She has gained in the buoyant hopes and aspirations of her citizens. She has gained a vantage ground that is destined to place her to the front in wealth, financial success, educational advantages and climatic benefits.

I cannot close this imperfect report without making honorable mention of Prof. J. W. Glenn, the very able Professor of Agriculture in the University of Tennessee, a position he has held with honor to the institution and credit to himself. He has maintained its agricultural department with singular ability and fidelity, and has done much toward fitting and qualifying students under his charge for the duties of farm life. Be it said to his credit that he has used his pen and voice in the furtherance of this object, often joining your Assistant in meeting the farmers at public gatherings in various portions of this section of the State in the interest of their calling. Wherever he went he infused life and vigor into their minds and magnified the importance of their mission.

And to you, sir, I extend my sincere regards and my profound gratification for the constant and uniform courtesy with which you have treated me.

Very respectfully, etc.,

C. W. CHARLTON,

Assistant Commissioner, etc.

GRASSES

—THAT ARE—

Best Adapted to the Meadows and Pastures

—OF—

TENNESSEE.

PREPARED EXPRESSLY FOR THE

FARMERS OF TENNESSEE.

Published by the Bureau of Agriculture, Statistics and Mines for the State of Tennessee.

INTRODUCTION.

No surer test of the degree of agricultural advancement of a country can be found than the relative acreage of land laid down to grass and devoted to tillage. Wherever the grass is most abundant there is the highest farming. This statement is most strikingly established by comparing the agricultural systems of France and England. In France 53 per cent. of the tillable land is annually sown in some kind of grain, while in England the grain-bearing per cent. of land is 25. On the other hand, while France has but 22 per cent. in grass, England has 50. Notwithstanding this difference in the amount of land devoted to grain, the yield of wheat to each inhabitant is almost identical in the two countries. Every acre of grain land in England receives, on an average, the manure from the animals fed off three acres of grass. In France, on the contrary, the manure made from each acre of grass has to be spread over two and a half acres of grain. In other words, each acre of grain in England gets nine loads of manure to one load given to the acre in France.

A further comparison would show that the acknowledged superiority of English cattle, sheep and other domestic animals, over those of France, or any other country for that matter, is due more to the superiority in quality and quantity of the meadows and pastures of that wonderful island than to anything else. If we turn our attention to other countries we shall find that the amount and character of grasses grown may always be taken as a measure of the degree of advancement to which their agriculture has reached. It must be borne in mind that this statement holds good only of the cultivated grasses, but of these it is perhaps universally true.

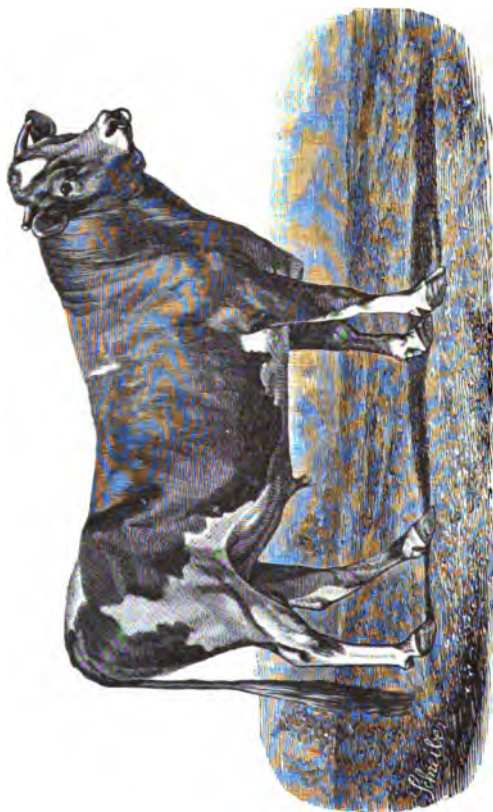
Under this test the agricultural system of Tennessee falls very low. It is a notable fact, often observed and commented

on, that the great, leading, dominating error in the farming of Tennessee has been, and is, the putting too much land in corn and oats, and too little in grass. Under this system a very large breadth of the land has been well-nigh ruined. Indeed, the damage is so serious that some change has come to be absolutely necessary. Judging from the experience of other countries, the one and only thing capable of redeeming this almost ruined land and saving the farmers from absolute bankruptcy, is grass.

Fortunately, the climate, soil and geographical locality of Tennessee all combine to render it by nature a grass region. In all the essentials to success in this great branch of agriculture, but few sections of the United States surpass East and Middle Tennessee, while West Tennessee is well suited to many grasses. It is not unreasonable to anticipate at no distant day, under an improved system of farming, these natural capabilities will be thoroughly and judiciously developed, and where now are only vast wastes and forests wilds, trackless and uncultivated, rich pastures will bloom and countless cattle roam. But no such result can come without a radical change in the system of farming.

From the circumstance of the peculiar position of Tennessee as a border State to the cotton belt, she has lost much time in agricultural progress. The large returns of the cotton planters South, and the wonderful ease with which they achieved great wealth, induced those living near to attempt the same role that succeeded so well farther south.

Tennessee possesses in her bosom all the elements of a grazing country. Scarcely a foot of land exists in all her borders that will not in an eminent degree meet the wants of some one or other of the grasses. Living streams of water, fed by perennial springs, as sweet as those of Castalia, hasten down the mountain slopes and lazily meander through the beautiful valleys. Being midway between the lakes and the gulf, we live just where the warm, moist southern winds encounter the condensing blasts of the north, so that we are rarely the sufferers from droughts. In fact, nature intended this State as a grazing region, while man in his thirst for riches has made it what it is.



TOLTEC (6881).

Sire of four tested cows.

Property of WEBSTER, MORROW & SON Nashville, Tenn.

Grass is wealth. As lowly and humble as it appears, it comprises about one-sixth of all the vegetation of the world. It nourishes more animals than all other food combined, and furnishes all the elements for the growth of animals.

Grasses are divided into two general classes, natural and artificial. The former includes those grasses with long, simple, narrow leaves, with a prominent mid-rib or vein in the center, and smaller ones running parallel to it, and at the base the leaf divides and clasps the stem in such a way that the stem seems to pass through it. As a rule the stem is hollow and closed at the joints, though a few are solid-stemmed. The classification of grasses would be impossible were their general appearance only considered. So great are the changes produced by modes of culture, by soil and climate, botanists, to arrive at the precise plant, therefore, have adopted characteristics that undergo no change, such as flowers, etc. From the rule of botanists in giving all plants technical names, it would be a difficult matter to recognize an old familiar friend under the new guise of a generic term; but we will endeavor, by giving also the name in common use, to remove this difficulty and bring them within the comprehension of any one who will take pains to properly read the descriptions.

Artificial grass includes all leguminous plants, such as clover, peas, beans, etc., while cereals, such as maize, wheat, oats, barley, rye, rice, sorghum, dhouro, chocolate-corn and broom-corn, though really true grasses, are generally classed with the artificials.

To one not acquainted with the subject, the facility with which grass scatters and diffuses itself is very surprising. But it seems that so important a vegetation should not be subject to the fancies or caprices of man. The seeds are prepared in such a way, that they are self-sowers. It is this remarkable facility of transportation that has given rise to the surmise of many, that it grows by spontaneous generation. Some of the seeds have hooks, and by these they fasten to any passing animal and are carried for miles. Others lie undigested in the crops of birds, or maws of animals, and are scattered with the dejectæ. Snows gather them on the hill-sides and bear them

far away on the melting torrents, and scatter them, mayhap, along some foreign shore. The air also assists in this, and lifts them on its wings, and they fly in all directions. When grass once stands, even if a passing beast cuts off its annual supply of seed, its rhizomes or creeping roots thrust their tender spongioles through the yielding soil, and thus many a field is clothed with verdure. And besides, many of the grasses are perennials, and though torn and tramped by stock, they gather new strength for another year, and push on their foothold.

There is a large class resembling the grasses in general appearance, but very different in the physical structure and nutritive elements. I allude to the rushes and sedges, of which there are over five hundred varieties growing in the United States, and eighty of them are found in Tennessee. What is commonly known as "broomsedge" is not a sedge at all, but a true grass, while the well-known "seed-tick" grass is a sedge.

There is a simple method of separating the grasses from these rushes and sedges, which will be briefly stated.

The sheath of sedges is a hollow tube, through which the stems pass, and it cannot be removed without tearing it open. This is not the case with grass, as the sheath can be stripped down, it being open to the joint. Besides, the leaves of all grasses are two-ranked, that is, the stem has leaves on each side, some opposite, others alternate, but always only on two sides. The leaves of sedges are three-ranked, or come out on three sides of the circle of a stem. In other words, the stem forms a circle of 360° . The grass leaves are 180° from each other, and the sedge leaves are 120° apart.

In the grass-like rush the flowers are divided into six points, within which are six stamens and a triangular ovary containing three seeds. A grass has never but one seed to the ovary.

The English farmer is able to take long leases of farms from the rich land-holder, at from \$20 to \$50 per annum rent. How does he pay this extravagant rent and support his family? He could not do it in any other manner than by improving, manuring and increasing the meadows with which they are constantly set. A Tennessean will manure his garden, and some-

times his corn land; but whoever thinks of spreading manure on his meadows? Yet the Englishman will spend large sums of money, and devote labor through the whole winter, in accumulating a large compost heap to apply to his meadows! The result may be imagined. While the Tennessee meadows will average from 800 to 1,500 pounds of hay to the acre, English meadows will make from two to five tons on land that has no other advantage than the care bestowed on it by the owner.

Besides this, the grass grown in a damp, cold climate is never so sweet and nutritious as that raised under a warm sun and with a quick growth. In this State there is an occasional drought that begins in June or July, interfering seriously with the development of the later crops. But such'a condition of climate is scarcely known in the earlier months during the growth of the grass crops. Yet there is with the spring rains a degree of temperature unknown to the Englishman, a degree sufficiently high to give grass all the necessary heat to enable it to attain its full supply of sugar and nitrogen from the soil.

The beautiful lands of Kentucky and Missouri, to say nothing of the Northern States, still retain a great value and are in demand at high prices. It is because these States have more land in meadows, while broad stretches of valuable pastures and prairies dot the landscape in every direction. Poor land will not make much grass, and without a great outlay of capital, land cannot be placed in first-class order at once. But it only requires a start, and then the persevering, provident farmer will soon see his farm blossoming as the rose. Land in Europe not infrequently reaches the sum of \$1,000 per acre for purely agricultural purposes, while here it is a difficult matter to extract, with our best farming, \$50 per acre, and then the expenses are to be drawn from that meager sum.

Let us draw a comparison between our leading staples. Cotton here will make on average land 800 pounds seed cotton per acre. This at the usual price makes \$20 per acre. Corn will produce on good land eight barrels per acre, and at \$2. the laborer will get \$16. Tobacco, our most remunerative crop, on good land will make 800 pounds of leaf, which is about \$50 to

\$60 per acre. Wheat will make on good land twenty-five bushels per acre, and at \$1.00 will yield about \$25. Taking the cost of production from these amounts, the average farmer will not have left, at the best, more than \$12 to \$15 per acre. A good meadow, in full bearing, with ordinary care, will yield, with two cuttings, at least two tons per acre. The cost is altogether in harvesting, while the trouble of sending to market is no greater than any one of the other crops. This, at the price for which it has been selling for several years, will be \$20 per ton. Here, then, is a difference in actual receipts of almost double that obtained from other crops, nothing paid out for production, and besides the land can be enriched year by year, until it attains an almost fabulous fertility. Nor is this all; the amount of hay produced from a single acre can be increased almost to any extent by the application of stimulating manures. If, then, land in Europe can produce five tons of hay per acre, and sell for \$1,000 per acre, why cannot Tennessee lands, far better naturally, and in a more genial climate, be made to rival these results? One thing only prevents, and that is the fatal apathy and want of enterprise on the part of the land owners. It is the thirst for immediate returns. To create this state of tillage it will be necessary to proceed slowly, and look for no returns of consequence for one or two years. Pressing necessities weigh upon the farmer, and he thoughtlessly drives on in the same interminable furrow, regardless of the loss of time and fertility. The Northern husbandman bales his hay, and is able to ship it to all parts of the South in search of a market, and after paying heavy railroad charges, is still able to sell his produce at a remunerative price. The Southern man has no freight charges to tax his hay, and yet he is content to let his Northern rival enjoy, without competition, this great market. When will our eyes be opened to our interests? is a question often asked, but difficult to answer.

A capitalist invests his money in United States bonds, and without risk or labor contentedly cuts off his coupons and enjoys his ease, while the merchant, with the same capital, is harassed to death meeting bills, collecting accounts and watching with unceasing vigilance the turn of the markets. So it is with farmers. A prudent farmer will invest his farm-capital

in grass, and he contentedly watches the growth of the grass and the browsing of his cattle, while his neighbor raising corn and cotton is busy all the year in cultivating his crops, watching his laborers, buying mules, bacon and hay from his more prudent friend, and when he counts his receipts at the end of the struggle, he will find his neighbor has absorbed the greater part of them. Not only this, but a stranger appears in the country desirous of investing in land, and while he would turn from the cotton plantation at ten or twelve dollars per acre, he would gladly invest in the grass farm at forty or fifty dollars per acre.

Land that will yield ten or fifteen dollars per acre clear of the expense of cultivation, cannot be supposed, and is not entitled to the same value with land that will produce thirty or forty dollars on the same breadth. And yet the farmers of Tennessee hesitate to pursue this course. Gulliver, in the midst of his extravaganzas, uttered a truism that will go down to all ages, when he said "the man who makes two blades of grass grow where one grew before, is a great public benefactor;" and when the citizens of Tennessee look at their own interests in a proper light, they will realize this truth, and then by acting upon it, double or even quadruple the intrinsic value of the lands of the State.

Grass means less labor, less worry, fewer hands, more enjoyment, finer stock and more charming homes, and as a consequence, happier families, more education, more taste and refinement, and a higher elevation of the moral character. Let grasses be sown and our homes beautified, and there will be more contentment, more satisfaction, less gloom and despondency, less carping and discontent.

MEADOW GRASSES.

The following are the most trustworthy grasses for the meadow in the latitude of Tennessee. I give both the common and scientific names, the average number of pounds in a bushel, the number of seed in an ounce, and depth of soil at which the greatest number of seed will germinate:

COMMON NAMES.	SCIENTIFIC NAMES.	No. of lbs. in bushel.	No. of Seeds in oz.	Depth soil in inches at which the greatest number of seeds will germinate.
Timothy-----	<i>Phleum pratense</i> -----	44	74000	$\frac{1}{4}$ inch.
Herd's-grass or Red-top-----	<i>Agrostis vulgaris</i> -----	12	425000	$\frac{1}{4}$ inch.
Orchard Grass-----	<i>Dactylis glomerata</i> -----	12	40000	$\frac{1}{4}$ inch.
English Rye Grass-----	<i>Lolium perenne</i> -----	18 to 30	15000	$\frac{1}{4}$ to $\frac{1}{2}$ in.
Italian Rye Grass-----	<i>Lolium Italicum</i> -----	15	27000	0 to $\frac{1}{2}$ in.
Millet-----	<i>Panicum miliaceum</i> -----			
Gama Grass-----	<i>Pripsacum dactyloides</i> -----			
Meadow Oat Grass-----	<i>Avena pratense</i> -----	5 $\frac{1}{2}$	118000	0 to $\frac{1}{2}$ in.
Means Grass-----	<i>Sorghum halapense</i> -----			
Red Clover-----	<i>Trifolium pratensis</i> -----	64	16000	0 to $\frac{1}{2}$ in.
Alsike Clover-----	<i>Trifolium hybridum</i> -----	64	16000	0 to $\frac{1}{2}$ in.
Sapling Red Clover-----	<i>Trifolium erectum</i> -----	64	16000	0 to $\frac{1}{2}$ in.
Crimson Clover-----	<i>Trifolium incarnatum</i> -----	64	16000	0 to $\frac{1}{2}$ in.
Lucerne-----	<i>Medicago sativa</i> -----	60	12000	
Sainfoine or Esparsette-----	<i>Onobrychis sativa</i> -----	26	10280	$\frac{1}{4}$ to 1 in.

TIMOTHY—*Phleum pratense*.

This grass is known in New England as Herd's-grass, from a Mr. Herd, who found it growing wild in New Hampshire, and introduced it into cultivation. Farther south, however, this name is only applied to Red-top, or *Agrostis vulgaris*.

Mr. Timothy Hanson carried it from New York to Carolina, and from him it is known as Timothy grass.

Its leaves are abundant near the ground, but those on the stalks are comparatively few. Like most other meadow grasses, it attains the greatest value as a food before the seeds are ripe. The latter are very abundant and highly nutritious. From ten to thirty bushels are made on good land.



It ripens late, and consequently favors the farmer very much, as he is able to save his wheat before cutting and curing his hay. It was a common custom at one time to sow it with clover, as it added to the value of the hay, and from the strength of its tall stem it prevented the clover from lodging, but the fact of its ripening so much later than clover, causing a great loss from shrinkage, has done away with this practice, especially as orchard grass is so much superior in that respect. Timothy is not suitable for pasturing, having scarcely any aftermath. Besides, the roots are easily destroyed if the stems are taken off below the first joint, this much being required for their vitality. For this reason, also, it is necessary to be careful to *set the blade of the mower sufficiently high to leave the first joint intact*. The roots of this grass are both fibrous and bulbous. Its bulbs have but few rootlets starting out from them, the plant depending for its support principally on the store of nourishment laid up within the bulbs. If, therefore, the stem is shaved off entirely, the bulbs, being deprived of all nourishment, throw out tubers all around, and these send up shoots, seeking food in the air, but they are feeble, and, if spared by the frosts of winter, are so crippled they fall an easy prey to the scorching suns of summer. For the same reason pasturing will effectually destroy a timothy meadow, if persisted in. The stock will bite off all foliage, leaving the roots to perish, or if hogs are allowed to run on it, they quickly discover and destroy the succulent bulbs. When

about half the blossoms turn brown, and at least the upper part of the spike or head is still purple, a yellowish spot will make its appearance at or near the first joint, and this is the true indication for the harvest to begin, for this spot will soon extend, if allowed to remain, to the spike, and the whole plant will be a stem of wood. The appearance of this spot also tells of the maturity of the bulbs, and they are not so liable to injury from cutting as before. If this joint is left, the tubers will remain green and fresh during the entire winter; but their destruction is inevitable if it is taken away at any time during the year. These remarks do not apply with equal force to timothy when it has a fibrous root, but the two kinds are so intimately mingled there is no practical difference.

Timothy stands at the head of all grasses in its nutritive qualities. A specimen taken from the field, according to the above directions, yielded on analysis: Water, 57.21; flesh-forming principles, 4.86; fat-forming principles, 1.50; heat-producing principles, 22.85; woody fibre, 11.82, and mineral matters, 2.26, in one hundred parts.—(Way.) A comparison of its relative value as a food will be made further on. But the above nutritious specimen will never be produced, if the plant is allowed to stand too long. On the contrary, as a food it would become woody and worthless, all its starch, sugar, albuminoids and other nutritive principles having been deposited in the seeds, and the stalk is nothing more than a woody support.

Cattle fed on this kind, or on hay that has been allowed to get wet and ferment, will quickly lose their flesh and the hair become rough.

Timothy is exhaustive to the soil, and, being a heavy feeder, requires attention. No crop can be raised on ground that will not extract a certain amount of its vitality, but unless something is taken the farmer would receive nothing. Therefore, it is the duty of the farmer to supply by manure the deficiency that occurs; and this is made the more apparent from the fact that the man who applies the most manure will invariably get the best returns for his labor. On good rich land—bottom is best—timothy will make two tons per acre. By a heavy application of compost or manure from the barn-yard, it can be

raised to five tons, and the straw lengthened from two feet, its usual height, to five and even six feet, and from the same cause, the heads from two inches to twelve inches in length.

It is a great and sure bearer of seeds, but the seeds are easily destroyed by heat in the mow, unless precautions are used in caring for them.

The time of sowing is various. If sown in the spring it is liable to be killed by summer heat, and if sown late in autumn it runs the same risk with frost. It is, therefore, bad policy to run the risk of not only losing the cost of seed, but also the labor of preparing the ground. Much must be left to the judgment of the farmer in selecting a suitable day, but it is safe to say that it should always be sown in the fall, early enough to get a root strong enough to resist winter killing. If sown in a very dry soil, it will incur the further danger of germinating from dews, and of being killed by the sun. Select the time when the ground is moist, and the days not excessively hot. The quantity of seed per acre is various, but the sower who spares his seed will reap in proportion. Not less than twelve pounds, if mixed, and if alone, at least three gallons of clean seed will be required to secure a good stand. But it will be better to test the seeds beforehand, for a failure from bad seeds will cause a year's delay.

Timothy does best on rich alluvial, moist land; but any rich land, whether upland or lowland, will produce it, if proper attention is given. Wherever calcareous loam exists it can be profitably put to timothy. It will not grow to any extent at a greater elevation than 4,000 feet above the sea, but on any less height there is no grass capable of greater diffusion.

In order to secure a stand of timothy, the following simple rules may be adopted:

1. Be sure of your seed by testing them before sowing.
2. Put plenty of seed on the ground; if too thin, it will require time to turf over; if too thick, it will quickly adjust itself.
3. Sow early enough to enable the seed to get a foothold before winter sets in. Late fall and winter sowings are always

precarious. September is best, if there is no drought, otherwise wait for a "season."

4. Unlike other grasses, timothy will not admit of pasturage. The nipping of stock will destroy the bulbs.

5. NEVER CUT THE SWARD BELOW THE FIRST JOINT.

6. Be sure to have the ground well pulverized.

It is necessary to impress one idea that has already been stated. Do not allow the timothy to stand longer than the time that the yellow spot appears near the first joint, as it will from that time ripen very rapidly, and be worthless. General Harding, before the Farmers' Club, called attention to the fact, that the greatest enemy of timothy is blue-grass. If stock is allowed to pass from a blue-grass pasture at will, to a meadow of timothy, they will quickly sow the meadow in blue-grass, and the latter will, in a short time, supersede the former. In the meeting above alluded to, timothy being the subject of discussion, Gen. Harding being called on for his views, said "he had had considerable experience with timothy. He regarded timothy as the most valuable of all the grasses for hay, and more especially for hay that must be handled or shipped, or baled. He had tried several varieties. Before the introduction of blue-grass our timothy meadows lasted almost without limit, and produced year after year for twenty or thirty years. But since we have been growing blue-grass more extensively, it gets into our timothy meadows and in a few years will root it out; so now, in buying my timothy seed, I look more carefully for blue-grass seed than for the seed of any noxious weeds. I would rather sow dock—I would rather sow anything in my timothy than blue-grass. Still, I value blue-grass in its place, as the first of grasses, yet it causes more trouble in our meadows than anything else. Again, our seasons have become dryer, and there is much greater difficulty in getting a stand of timothy than formerly. When I commenced sowing meadows, I had no trouble in getting a stand of timothy, whether I sowed the seed in the fall or in the spring, whether I sowed in the fall with wheat or barley, or in the spring with my oats. For many years I never failed. Now I sow in the fall, and the timothy is

frequently winter-killed; I sow in the spring, and it is killed by the long droughts of summer. But these difficulties should not deter us; we should continue to sow, and persevere until we get a stand. Hence, if I sow in the fall and my timothy is killed, I sow in the spring; if it is then killed, I sow again and again until I succeed. I have never given up, and have never entirely failed after repeated efforts. I got a good stand of timothy many years ago with a gallon of seed to the acre, now I would recommend not less than one and one-half gallons, or even a peck of seed to the acre. Again, the better the stand you get, and the thicker your grass comes up, the more will it keep out the weeds. The white blossom, like the blue-grass, has also increased largely, and seems to be yet increasing. That is a troublesome weed for our meadows, still it is not as pernicious as it seems to the inexperienced. True, you cannot sell white blossom in the market, but if you expect to consume the hay at home, and make your timothy with a large amount of white blossom in it, you will find you will have good hay. Stock will eat it, and readily; mules and cattle seeming to do almost as well upon it as upon the timothy alone.

“I know that some differ from me in considering the white blossom as troublesome as any other plant, and throw it away. I have some hands to run along the windrow and pick out the white blossoms, and make hay of the white blossoms alone. It pays very well for the labor of separating it. I will not throw the white blossom away, for it is valuable. I stack it in my pastures and let the cattle go to it at will during the winter. I also stack my straw, and that helps the cattle.

“Now, what is the proper time to cut timothy? Some would say as soon as it blooms; others would say after it has bloomed and the bloom has fallen. If I could cut it all on the day I thought it would make the best hay, I would cut it just about the time it has lost the largest portion of its bloom. If you cut it too green—like green fodder—the stalk will shrivel, and after being cured, the stalk will break short; but if allowed to get a little ripper the stalk will bend.

“How much sun should it have? This is a question that can only be determined by experience. The proper time to put it

up is when it has had as little sun as possible, so you are assured it will not mould. If there is too much moisture in it, it will mould, and thereby injure the hay. If the weather is settled, it will cure better in cocks, but all these things must be governed by circumstances."

It is highly probable that the reason Gen. Harding's meadows fail in six or seven years, is the fact, he admits, of pasturing them. It is a well ascertained fact that timothy will not bear pasturing, and attention to this and leaving the first joint uncut will most probably make our meadows again live twenty or thirty years.

At the meeting of the Stock Breeders' Association in February, 1878, Gen. W. H. Jackson said that the best forerunner of timothy is Hungarian grass. If this is sown in the summer and harvested in August or September, and timothy sown upon the stubble and harrowed in, the best stand could be obtained. The Hungarian grass destroys all noxious weeds, and gives a certain degree of compactness to their soil necessary to secure a good stand of timothy.

RED-TOP—HERD'S-GRASS—*Agrostis vulgaris*.

It was introduced from England, where it was known as Bent grass. When first cultivated it went by the name of English grass. There are many species now raised in England, which are still known as fine Bent. It is scattered over the whole State, and but few old pastures are free from it, but there it is so dwarfed by close grazing and treading that it shows to but little advantage. It is commonly called in these situations fine-top.

Next to timothy as a meadow grass stands Herd's-grass. Unlike the former, it also makes a good grazing grass—in fact, grazing is necessary to its preservation, as, if allowed to go to seed a few years, it dies out. It loves a moist soil, and on swampy places that will grow scarcely anything else, Herd's-grass will thrive wonderfully.

It is the most permanent grass we have, and by means of its long, creeping roots, will, even if sown too thin, quickly take possession of the ground. It is greedily eaten while young and tender in the spring, by all kinds of stock, and affords a fine nourishing hay, though in less quantity per acre than timothy. It grows from two to three feet high, and with its purplish panicles, when in full bloom, presents a most charming sight in its soft, feathery undulations.

It is oftener mixed with other grasses than sown alone, especially with timothy and clover. But it fails to come into harvest as early as clover, and the same objections may be urged against it that are to timothy.

It yields, on moist bottom land, from one and a half to two tons per acre, but on uplands it is not a good producer. On thin lands it will not gain a sufficient height to justify harvesting at all. It withstands the effects of drought much better than timothy. In England it is supposed to grow best on sandy soils. Its effects, when fed to milk cows, are to greatly enrich and yellow the butter, and European dairymen think they cannot do without it in their pastures. By the Wopurn experiments, at the time of flowering, it yielded 10,209 pounds of grass, which lost in drying 5,615 pounds, and furnished 532 pounds of nutritive matter. Cut when the seeds were ripe, it yielded 9,528 pounds of grass, which lost exactly half its weight in drying, and afforded only 251 pounds of nutritious matter. From this it would appear that this grass is doubly as valuable for feeding purposes when cut at the time of flowering.

For stopping gullies in old fields it is superior to blue-grass, as it will throw its long, searching roots from the top down the sloping banks of the washes, and fasten to every patch of good soil at the bottom, and then from every joint starts up a stalk to get a fresh hold. It affords a very good aftermath from which, in wet falls, a fair crop may be cut. Unless well tramped in the late fall it is liable to form tufts that rise out of the soil from the effects of freezing, and is destroyed. Therefore, after cutting, let on the stock, and their feet will insure a good turf, and besides, will destroy weeds. But the cattle should be taken

off the pasture after rains have filled the earth with water, or it will become too rough for the proper use of the mower.

The quantity of seed per acre, when sown alone, is about one bushel. The seed is usually sold in the chaff, it being difficult to separate it.

The time for harvesting is when it is in full flower, or as soon thereafter as possible, when all the elements that are necessary to form the seeds are still in the stalk and leaves. Left to ripen fully it becomes woody and innutritious.

Many pursue the plan of sowing the timothy and Herd's-grass together, as they ripen together, and the Herd's-grass being much lower than the former, fills in well, and the two will make a more abundant yield than either separate. But one requires pasturage, and that will destroy the other.

It should be sown in September, unless sown on wheat, and then as early as practicable, to enable the roots to get sufficient depth to resist the cold of winter. If sown alone, it will, like timothy, make about a half crop the ensuing year, but it is usually sown with grain, wheat, rye or barley. There are a great many marshy spots in Tennessee, especially on the Tennessee and Mississippi Rivers, so full of water that nothing can be cultivated on them, and on these fine crops of Herd's-grass could be secured every year, which would certainly be far preferable to allowing them to run to waste. These bottoms are usually of surprising fertility, and would go far to supply the great deficiency of hay, and obviate the necessity of importing from our more thrifty Northern neighbors. It is a perennial, and if properly tramped every autumn will keep good an indefinite length of time.

This grass also finds a most congenial soil throughout West Tennessee, in many places in that division of the State attaining the height of five feet. It is probably better adapted to all the soils of the State than any other grass. I have seen it growing in princely luxuriance 6,000 feet above the sea on the bald places of the Unaka Mountains. It flourishes upon

the slopes and in the valleys of East Tennessee. It yields abundantly upon the sandstone soils of the Cumberland Table-land, and beautifies the rolling surfaces on the Highland Rim. In the Central Basin it sparkles in the beauty of its verdure, and is second only to red clover and timothy as a meadow grass. No other grass is sown so much for hay upon the lands lying at the western base of the Cumberland Table-land. In Warren County especially it is highly esteemed for its longevity and fruitfulness.

ORCHARD-GRASS—*Dactylis glomerata*.



Whether a native of America or Europe, or indigenous to both countries, it is well known that orchard-grass is diffused more extensively than any other grass, growing all over Europe, the northwestern parts of Africa, and in Asia Minor. Known as cock's foot in England for many centuries, it was not appreciated as a forage plant until sent to that country from Virginia. It is a perennial, and grows upon congenial soils anywhere between 35 and 47 degrees north latitude. It likes a soil moderately dry, porous, fertile and inclined to be sandy.

On stiff clay soils retentive of moisture, the roots do not acquire such a vigor as to give a luxuriant top growth. The feebleness of the roots upon such a soil makes them liable to be thrown up by the earth. It may be grown successfully on a lean, sterile soil, by a top-dressing of stable manure, yielding during a moderately wet season from two to three crops. In its rapid growth in early spring lies one of its chief merits, furnishing a rich bite for cattle earlier than almost any other grass. It also grows later in the fall. It is very hardy when well set, makes a great yield, grows rapidly and vigorously upon suitable soils, supplies a rich, nutritious hay, which, compared with timothy, is in value in the proportion of 7 to 10. It

starts out early in spring, and comes into blossom about the time of red clover. It attains a height, upon good soils, of three feet, though upon soils of great fertility it sometimes reaches the height of five feet. After being cut, it springs up rapidly, sometimes in rainy weather growing three or four inches within a week. This quality of rapid growth unfits it for a lawn grass unless cut every week.

Nevertheless, this very quality makes it stand unrivaled as a pasture grass. The Hon. John Stanton Gould says in his essay upon this grass: "The laceration produced by the teeth of cattle, instead of injuring, actually stimulates it to throw out additional leaves, yielding the tenderest and sweetest herbage."

The chief objection to orchard-grass is that it grows too much in stools or tussocks. This can be remedied by sowing a larger quantity of seed per acre. Never less than two bushels (14 pounds to the bushel) per acre should be sown, and two and a half bushels would even be preferable. Mr. Gould says that if the meadows are dragged over in spring with a fine-toothed harrow, and then rolled, this disposition will be completely overcome. The disposition to stool can also be checked by sowing with other grasses. A half-gallon of clover-seed, one gallon of Herd's-grass, and two bushels of orchard-grass, per acre, sown about the 25th of March, in our latitude, will make an excellent pasture. By the middle of June, upon good soils, the amount of forage will equal the best fields of clover. It should not, however, be pastured the first season until August, however tempting it may be. In this many Tennessee farmers have made a mistake. By pasturing before the roots are well established much of the grass is pulled up and destroyed. I have met with many farmers who condemned the orchard-grass for want of hardiness and endurance, but in every case the fault was with the farmer himself in pasturing too early.

Orchard-grass grows well in the shade, and hence its name. It withstands, hot, dry weather better than any other valuable grass. Three good crops of leafy hay, if the weather is seasonable, may be counted on after the first year, but only one will blossom.

The analysis, by Prof. Way, of the green grass in blossom, gives the following result :

	<i>Per cent.</i>
Water.....	70.00
Fatty matter.....	0.94
Flesh formers.....	4.06
Heat producers.....	13.30
Woody fibre.....	10.11
Ash.....	1.59

Analysis by Scheven and Ritthausan gives :

	<i>Per cent.</i>
Water.....	65.00
Fat.....	.80
Flesh formers.....	3.00
Heat producers.....	12.60
Woody fibre.....	16.10
Ash.....	2.40

The hay made of orchard-grass, as analyzed by Wolff and Knop, gives :

	<i>Per cent.</i>
Water.....	14.8
Organic matter.....	81.1
Ash.....	4.6
Albuminoids.....	11.6
Carbohydrates.....	40.7
Crude fibre.....	28.9
Fat.....	2.7

It is of great importance that the seed from hardy plants be sown. In no department of agriculture does the old maxim "like produces like" obtain in a greater degree than in this grass. Seed from weakly, sickly plants will produce the same

kind of offspring, however fertile the soil may be. Messrs. Lawson & Son, by selecting the best seed, and sowing for several years none but the best of each generation, established a new variety of orchard-grass, known by its great size and vigor as the giant cock's foot. Let farmers be careful, therefore, in saving seed to sow from the most vigorous growth.

The reason why so many bare spots are seen in pastures and meadows of this grass is due to two causes: First, the land is generally not half prepared to receive the seed; and, second, there is a penny-wise and pound-foolish policy in sowing too few seed. Let the land be well broken by deep and thorough plowing, and then be finely pulverized by repeated harrowings. Sow the seed, the thicker the better, and run a light brush or harrow over the land so as to cover the seed slightly. To sum the whole matter up, "plow the land deep, pulverize the soil well, be generous as to the quantity of seed, let that seed be good, sow it evenly, give the land as good treatment afterward as is given to meadow lands in timothy."

Its chief superiority over timothy lies in the value of its aftermath. It will improve under depasturing when a timothy meadow would be rendered worthless.

To sum up the merits of this grass:

1. It is better suited to every variety of soil than any other.
2. It will grow with greater rapidity than any other grass, and for this reason will sustain a larger number of animals, and is excellent for soiling purposes.
3. It will grow in the shade. This quality will enable the farmers to utilize their wood-lands as pastures, and so make them a source of profit.
4. It will resist drought better than any other grass. The hot summers make this a very valuable quality in any grass. Often in July and August the pastures become so parched as to afford but a small amount of grazing. Orchard-grass then comes to the rescue and supplies the deficiency.

5. It is both a pasture and a hay grass. After a crop of hay has been taken off in June, the aftermath will furnish a good pasture throughout the remainder of the summer.

6. It may be sown in the spring or fall with small grain, or alone. It is best not to sow it with grain, as the extra production of grass, when sown alone, is worth more than the grain and grass grown together.

ENGLISH RYE GRASS—*Lolium perenne*.

This was the first grass cultivated in England, and is a great favorite, occupying the same position there that timothy does with us. It is but little cultivated in the United States, though some successful experiments have been made with it in Tennessee. It is of quick growth, and will sometimes yield forty bushels of seed per acre. It produces a nutritious herbage. There are no less than seventy varieties produced in England.

One of the most valuable species of this grass is the *Lolium Italicum* mentioned below.

ITALIAN RYE GRASS—*Lolium Italicum*.

Prof. Way gives the following analysis of this grass: Water, 75.61; flesh-forming principles, 2.45; fatty matters, .80; heat-producing principles, 14.11; woody fibre, 4.82; mineral substances, 2.21.

This grass has been lately introduced from Europe, where it is said to be more universally adapted to all sorts of climates than any other grass, and is very popular there. It grows from two to three feet high, and on moist, rich land, will perhaps bear cutting as frequently as a soiling or green forage crop, as any other grass, affording a succession of green cuttings until late in the fall. It can be forced by manures and irrigation to a greater extent than any other known species of hay.



However, as can be seen from its analysis, it has, when green, nearly half less nutrient properties than timothy, and unless the farmer wishes to cut it as a green food, it has no advantages over the latter. It is an annual with a fibrous root, and bears grazing well. The time of sowing is early fall, and ten pounds of seed are required per acre, a bushel weighing eighteen pounds. It is a valuable grass for Southern farmers, where hay is scarce and high. Being sown in the fall, the farmer will be enabled to cut it early in the spring, thus giving the stock a change from corn alone to succulent hay. It has been fully tested in Georgia, and has given great satisfaction. It gives a fine color to the butter of cows fed on it, and they eat it with great relish. It withstands the hottest suns of summer, as well as the frosts of the severest winter. It must be sown alone, as it will quickly choke and destroy clover or other grasses. Its yield per acre, according to received authority, is immense. Mr. Dickens, of England, sowed it on a stiff, clay soil, well manured, cut it ten times during one year—the first time ten inches in March; April 13th again; May 14th a third time; May 25th a fourth time; June 14th again; July 22d a sixth time, with ripe seed and three loads of hay to the acre. Immediately after each cutting it was manured with liquid manure, the produce of each crop increasing with the temperature of the atmosphere, from three quarters of a load, the first cutting, to three loads the last. He discontinued manuring now, thinking its growth would be terminated in bearing seed, but he afterwards cut four

crops from it. On the 26th of January following, it measured sixteen inches in height. The last cutting was October 30th, and on the 8th of April a crop twenty-two inches high was cut from it. "I was desirous to know the exact amount taken per acre for the year, and it amounted, on a careful measuring and weighing of green hay, to thirteens tons and eighteen hundred and twenty-seven pounds per acre."—*Coleman's European Agriculture.*

It presents a most charming view, with its broad, dark-green foliage, and especially in a dry year, when vegetation is parched up all around, it does not show any signs of losing its fresh, living, luxuriant growth. Although an annual, a meadow of this grass may be made perennial by scattering fresh seed over the ground every second year, and scratching it with a harrow with sharp teeth. Its unusual ability to withstand the vicissitudes of heat and cold would make it a desirable grass in any thirsty soil, as well as in moist ones, and might possibly be a valuable addition to the soils of the western portion of our State. At least it is worthy of a trial.

Mr. Gould thinks the valuable qualities of this grass may be summed up as follows.

"Its habit of coming early to maturity.

"Its rapid reproduction after cutting.

"Its wonderful adaptation to all domestic animals, which is shown by the extreme partiality they manifest for it, either alone or when mixed with other grasses; whether when used as green food for soiling, as hay or as pasturage, in which latter state its stems are never allowed to ripen and wither like other grasses.

"Its beneficial influence on the dairy, not only augmenting the flow of milk, but improving the flavor of the cheese and butter.

"Its uncommon hardiness and capacity to withstand the vicissitudes of both wetness and dryness."

CRAB OR. CROP-GRASS—*Panicum sanguinale*.

This grass must not be confounded with the *Eleusine Indica*, also called crab-grass, from its supposed resemblance to crab.

This species is so familiar to every Southern farmer that it would seem to be superfluous to notice it. But as little as it may appear, it is one of our most valuable indigenous grasses.

Crab-grass is an annual, and so full of seed is it that it is never necessary to sow it. It is never cultivated alone, which could be easily done by sowing the seed on a smooth surface about the first of June. When the cultivation of a piece of ground ceases, it at once takes possession, and soon furnishes a fine pasture. It grows not only in the cultivated fields, but in old pastures, yards and woods.

It is a fine pasture grass, although it has but few base leaves, and forms no sward, yet it sends out numerous stems, branching freely at the base. It serves a most useful purpose in stock husbandry. It fills all our cornfields, and many persons pull it out for hay. It makes a sweet food, and horses are exceedingly fond of it, leaving the best hay to eat it. Should it be desired to secure a good crop of it, do not pasture the wheat or oat stubble, except with hogs, until the crab-grass gets a good start, then take off the hogs and allow it to get into bloom, and if the land is good, there will be a paying quantity to save. It should be sedulously guarded from rain.

MILLET—*Panicum Miliaceum*.

There are a great many varieties of this important grass, and almost every year adds to the list of them. The preference for any variety is arbitrary, yet there are many advantages belonging to all. But so far as the planter is concerned, one description serves for all, as the mode of culture is the same, and the only difference is in the botanic characteristics.

The first millet cultivated in this State was the kind commonly called Tennessee millet. In a few years the Hungarian grass, or millet, became popular. It does not yield so much hay, but it is eaten with more avidity by stock. The Missouri, which is only a modification of the Tennessee; next became the favorite, and then the German millet came and superseded all others. The manner of its introduction was in this wise:

Two Germans came to Tennessee in 1861. One of them brought a little sack of millet seed, about a quart, which he kept in his trunk during the war. At the close of the war he took it out one day, and handing it to a merchant on Market street asked him to give it to some good farmer for planting. The merchant gave it to Mr. James Allen, of Williamson County, one of the best millet seed planters in the State. The crop was the admiration of the whole country, and he gave a half bushel to Dr. W. M. Clark. He planted the entire amount, and wrote concerning it, so that the seed sold for from \$3.50 to \$5 a bushel. It has taken precedence of all other varieties.

Last year the Department at Washington sent out a new variety, called "Pearl millet." It has proved, however, to be a variety that has been planted for many years in the extreme Southern States, and is of but little value unless cut as a green forage. It grows rapidly and is eaten with relish by stock. But if allowed to attain full growth or produce seed, it cannot be eaten, as it becomes woody. It may be cut every six weeks through the season, or when it gets high enough to be reached by a mowing blade.

We will now give its cultivation in general and its use, which embraces every variety as well as one.

At one period, it was deemed sufficient food for any stock, without the aid of anything else. The hay was fodder and the seed was corn. But later investigations have demonstrated the fact, that when hay ripens to seed, its usefulness as a hay measurably ceases. Were stock fed exclusively on seed-heads, with a sufficiency of good hay, they would thrive exceedingly well, or if the millet is cut while in the flower, or even when the seed

is in the milky state, and fed to stock in combination with grain, they would do well. But even then, it is much inferior to oats, timothy or Herd's-grass. Its special recommendation is, that it yields a larger proportion of hay than other grasses. It requires a rich, dry soil, and will stand almost any amount of droughts, seeming to dry up during the heat, but when it rains it will start off with renewed life, and do as well as ever. It makes large quantities of seed per acre, the Hungarian yielded thirty bushels; the Missouri, forty; the Tennessee, fifty, and the German from sixty to eighty bushels per acre. The Hungarian millet is a better hay than either of the others, but its yield is much less. The Tennessee millet perhaps yields more hay than either of the other three, but the Missouri has more reputation as a feed for cattle. Should it be wished, however, to sow for a money crop, it will be far preferable to sow the German millet. The Hungarian has a small head, a simple spike, while the others have compound spikes, most notably the German. It is easily raised, at less cost than corn, and makes, on good ground, nearly double as many bushels as the latter per acre. For all kinds of fowls it is unsurpassed, and it is a powerful stimulant to laying eggs. •

To sow for hay, prepare the ground in a thorough manner, pulverizing it completely, and when the ground is in a sufficiently moist condition, in June, sow the seed, a bushel to the acre. Never sow if the ground is too dry or too wet. If too dry, the seed near the surface will parch in the rays of the sun, and a stand will fail to appear. If too wet, the usual injury to the land occurs, and the crop "frenches," or turns yellow and dwarfs. After sowing, harrow well and the labor is over. The millet will require seventy or eighty days to mature, unless it is sown in July, when it will require a few days longer.

Two crops of Hungarian grass can easily be raised from the same ground annually. A farmer of Davidson County raised a most excellent crop of Hungarian grass, sown the 1st day of September, and cut the 10th of October. Another, of Williamson County, secured a good crop of German millet, sown on the 13th day of August, and cut on the 12th day of October.

For seed, prepare the ground as above described, and then, with a light bull-tongue or skooter plow, run light parallel rows thirty inches apart, and with a tin cup or oyster can that has three or four holes punched in the bottom with a 4-penny nail, walk rapidly along the furrow, and the seed will sift into it from the cup about right for a stand. Cover very lightly with a cotton coverer, and when the seed begin to sprout, but before they show the sprouts above ground, run over the field with a harrow, so as to loosen the ground and destroy weeds. Afterwards cultivate with a cultivator and double-shovel, one plowing with each being all that is required. It will be necessary to thin out the Tennessee millet with hoes, leaving a mere thread of stems, as it stools prodigiously; but this will be unnecessary with any of the other three, as they scarcely stool at all.

To save it for seed, it must be cut with reap-hooks, taking just enough of the head to enable the laborer to make it into bundles, or if preferred, it can be broken off at the head, taking only the seed, leaving the stubble to renew the soil. They are, after treading out in a barn or on a clean spot, separated from the chaff with an ordinary wheat fan.

This grass is of great value to the renter who has no opportunity of continuing in possession of the land long enough to set a meadow. A crop of millet is a good forerunner for a meadow, as it destroys all the noxious weeds, and leaves the land in a fine condition for timothy or Herd's-grass.

GAMA GRASS—*Tripsacum dactyloides*.

This is in some sections called sesame grass. It is the largest and one of the most beautiful grasses we have, growing to the height of seven feet. It is abundant throughout the Mississippi Valley, on moist, slushy places. When young and succulent it is eaten with avidity by stock, and makes, from its rapid growth, a good soiling or forage crop, but when it gets large its stem is so woody stock refuse to eat it. Its leaves are very large, equal in size to the leaves of corn, but they are rough and hairy.

The grass may be cut three or four times a year, and though in its native state it grows in swamps, it thrives almost equally well on dry or sandy ridges. It will grow where timothy or Herd's-grass will not, and consequently is well suited to a large section of our State. The quantity of hay taken from one acre is simply enormous, and resembles very much corn fodder, and as a hay is fully equal to it, and it can be saved at one-tenth the labor required to save fodder. The roots are strong and large as cane roots, so let it be sown where it will not be desired to remove it. However, close grazing for a few years will destroy it.

It is very nutritious and succulent when cut green. The great mass of roots it has will serve to open, loosen and improve the land upon which it grows. It should never be allowed to shoot up the seed stem when desired for hay.

It is with difficulty the seed can be made to vegetate, and therefore it must be propagated by slips from the roots. Prepare the land well, lay off the furrows with a bull-tongue plow two feet apart, and drop a small piece of root about two feet apart in the furrow, covering with a board. The creeping roots will soon meet, and the ground is quickly turfed with it. It should be planted early in September. Of course, the richer the land, whether upland or bottom, the greater the yield, as the time has never yet come when poor land will make better crops of anything than fertile land. I have seen it growing with great luxuriance in Montgomery County.

MEADOW OAT GRASS—*Avena pratensis*.

This is a perennial grass, and is a native of Great Britain. It is one of the few grasses that do best on a dry soil. It grows to a height of only eighteen inches in its native pastures; but here it is quite a different grass, and rises to the height of five or six feet. It will not grow well on moist soils, but on rich upland or good sandy land it grows with vigor. It deserves a place on every farm, as the hay is excellent, and is greedily eaten by stock, and besides, the yield is extremely large. An-

other advantage is that the seed will be ripe before the hay turns yellow, so that not only the hay will be saved, but a large amount of seed can be secured; upon a barn floor enough will shatter out to supply the wants of most farmers. Or if the farmer wishes to sell the seed, he can cut off the heads with a cradle and let the mower follow for the hay.

Should the autumn prove a wet one, a second crop can be cut; but if there is not sufficient aftermath to justify cutting, do not pasture it, but allow it to grow on as long as it will, and about Christmas it will turn over and the tops turn yellow, all prepared for the hungry stock, and it will continue to sustain them until other grasses take its place. However, should it be desired to use it for hay the succeeding year, the stock should be removed about the middle of February.

It will seed in the fall after being sown in the spring, which is the proper time to sow it. Sow two bushels per acre. The seed is very light and chaffy. It is a tussock grass, and does not spread from the roots, consequently the seed must be depended on for a stand. After the first sowing there will be no difficulty in obtaining seed, as the yield is large. It affords, both for hay and pasture, perhaps, more green food than any grass we have.

SORGHUM—*Halpense*.

Egyptian Sugar Cane, as its proper name is, is a daughter of the Nile, where it grows fifteen or twenty feet high. So great is its luxuriance there that it has filled all the upper Nile so that a canoe cannot be driven through it. Great numbers of cattle and wild animals resort to it, and, in fact, it is the chief sustenance of ruminants in that country.

When young it is very tender and sweet, the pith being full of sugary juice. The leaves are large as corn fodder, and very nutritious. It has a perennial root, and so vigorous that when once planted it is a difficult matter to eradicate it. So care must be taken to plant it where it is not intended to be disturbed.

The roots are creeping, and throw out shoots from every joint. It is a fine fertilizer, and sown on a piece of poor washed land, will, in a few years, restore it to its pristine fertility. But there is really not much difference where it is sown, for a farmer once getting a good stand, will not want to destroy it. It will bear cutting three or four times a year, and, in fact, it has to be done, for when it matures the seed, the stem and leaves are too coarse and woody for use.

The ground must be well prepared as in other grasses, and in September, the earlier the better, let it be sown one bushel to the acre.

It can be propagated also by the roots by laying off the rows each way, and dropping a joint of the root two feet apart and covering with a drag.

It gives the earliest pastures we have, preceding blue-grass or clover a month. Hogs are fond of the roots, and any amount rooting in it will not injure it. In fact, it is a *stick-tight*. It not only thrives well on bottoms, but it will grow just as well on upland, and though poor upland will make little hay, yet it makes a fine pasture. It disappears in the winter altogether, but the first warm weather brings it up, and it grows with astonishing rapidity. On our lands and in our climate it will grow from five to seven feet high, while in South Carolina it will grow twelve feet high.

For soiling purposes it is not equaled by any grass in our knowledge, as it can be cut every two or three weeks.

Many persons object to it on account of its great tenacity of life, matting the soil in every direction with its cane-like roots, and the rapidity with which it will spread over a field, and the difficulty of eradicating it. But these very objections should be its recommendation to owners of worn-out fields; and if it be desired to destroy it, it is only necessary to pasture it closely one year, and then in the fall turn the roots up with a big plow to the freezes of a winter, renewing the breaking up once or twice during the winter, and then cultivating the next spring. The seeds are quite heavy, and weigh thirty-five pounds to the

bushel. Every one who has tried it recommends it to the public. But some allowance must be made for the partiality of friends, and it would be well to give it a trial before engaging in its culture to any extent. There would, however, certainly be no risk in sowing it upon those worn-out hill-sides, so many of which form an unsightly scar upon the face of nature in Tennessee—the tokens of the past.

A proximate analysis made by the Department of Agriculture at Washington, gives :

	<i>Per cent.</i>
Oil.....	2.26
Wax. ....	.61
Sugar	7.37
Gum and dextrine.....	5.14
Cellulose	25.1
Amylaceous cellulose	25.87
Alkali extract.....	15.58
Albuminoid	18.18
Ash	4.85

Analysis of the ash in the Johnson grass :

	<i>Per cent.</i>
Potassium	3.68
Potassium oxide.....	35.72
Sodium .....	.81
Calcium oxide.....	12.87
Magnesium oxide.....	.78
Sulphuric acid	2.96
Phosphoric acid.....	10.44
Silicic acid	22.21
Chlorine	4.58

RED CLOVER—*Trifolium pratense*.

This valuable forage plant was first introduced into England in 1645, during the stormy times of Charles I., and rapidly met with favor throughout the kingdom. It properly belongs to the leguminous family, which includes a considerable number of other forage plants that are called artificial grasses, to distinguish them from the true or natural grasses called *gramineæ*. The botanic name *trifolium* comes from two Latin words, *tres*, three, and *folium*, a leaf, and in England it is often called trefoil. It may always be

known by having three leaves in a bunch, and the flowers in dense, oblong and globular heads.

There is no grass, natural or artificial, that is more useful to the farmer or stock-grower than red clover. It has been styled, with some show of reason, the corner-stone of agriculture, and this not only on account of its vigorous vitality, but because it adapts itself to a great variety of soils. It is widely diffused, and abounds in every part of Europe, in North America and even in Siberia. It furnishes an immense amount of grazing, yields an abundance of nutritious hay, and is a profitable crop, considered with reference to the seed alone. But beyond all these, it acts as a vigorous ameliorator of the soil, increasing more than any other forage plant the amount of available nitrogen, and so becomes an important agent in keeping up the productive capacity of the soil, and increasing the yield of other crops.

SOILS ADAPTED TO ITS GROWTH.

Red clover is a biennial plant, and under judicious tillage may be made a perennial, and is specially adapted to argilla-

aceous soils, but it will grow well upon sandy soils, when a "catch" is secured, by the application of a top-dressing of gypsum or barn-yard manure. I have seen it growing with vigor upon the feldspathic soils of Johnson County, upon the sandstone soils of the Cumberland Mountain, and upon the sandy loams of West Tennessee, but it finds a more congenial soil in the clayey lands of the valley of East Tennessee, on the red soils of the Highland Rim, and on the limestone loams of the Central Basin.

The clayey lands of West Tennessee have no superior for the production of clover. It often grows upon these lands from four to five feet in height, and forms a mat, when it falls, of great density and thickness. As much as four tons of clover hay have been taken from a single acre. Probably three-fourths of the lands in Tennessee will grow clover remuneratively, and of the soils which will not, a large portion is included in the old gullied fields that constitute the shame and mark the thriftlessness of too many of the farmers. It may be set down as an infallible rule in the State of Tennessee that good farming and abundant clovering go together.

SOWING CLOVER.

Clover may be sown in the latitude of Tennessee upon wheat, rye or oat fields or alone. Instances have been reported to me where a splendid stand was obtained by sowing after cultivators in the last working of corn in July. This is unusual, however. So is fall sowing. The best time to sow is from the first of January until the first of April. If sown in January or February, the seed ought to be sown upon snow. This is not only convenient in enabling one to distribute the seed evenly over the land, but the gradual melting of the snow, and the slight freezes, bury the seed just deep enough to insure rapid germination when the warm days of March come on. For the same reason, if sown in March, the seed ought to be sown when the ground is slightly crusted by a freeze. If the sowing is deferred until too late for frosty nights, the land should be well harrowed and the seed sown immediately after the harrow. It will hasten germination and cause a larger proportion of seed to grow, to

harrow the land after the seed is sown. With oats, the seeds should be sown after the last harrowing or brushing, with a slight after-brushing to cover them.

A better stand of clover, with less seed, may always be secured by sowing upon land prepared for clover alone. I have often obtained an excellent catch upon "galled" places by breaking the land well, and sowing the seed without any previous or after-harrowing.

Upon good, fresh, rich soils, where clover has not previously grown, one bushel for eight acres will be sufficient. If the soil is thin and unproductive, one bushel for six acres ought to be sown. If the land has been regularly rotated with clover, one-half the quantity of seed mentioned above will suffice, sometimes much less.

The frequent failure to secure a good stand of clover admonishes the farmers of the State to exercise more care in the seeding. When sown late in the spring many of the seeds sprout, and are killed by dry weather. It would be all the better if the clover seed could be buried a half-inch (or even an inch on loose soils) beneath the surface after the middle of March.

GROWTH AND MANURE.

Red clover rarely makes much growth the first season if sown with grain. Should the weather be very seasonable after harvest, and the land fertile, it will sometimes attain the height of thirty inches and put out blooms, making an excellent fall pasture. When sown alone it will always blossom in August.

As soon as it begins to grow, in early spring, an application of two bushels of gypsum or land plaster, upon granitic or sandy soils, is absolutely necessary to get a good growth.

Baron Liebig, after numerous experiments made with gypsum upon clover, comes to the conclusion that the action of gypsum is very complex; that it indeed promotes the distribution of both magnesia and potash in the soil. He thinks that gypsum exercises a chemical action upon the soil, which extends to any

depth, and that in consequence of the chemical and mechanical modification of the earth, particles of certain nutritive elements become accessible to and available for the clover plant, which were not so before.

Though having my mind constantly directed to this point, I have rarely found an application of gypsum beneficial upon clayey loams, but its effects are very apparent on strong limestone soils, such as are found in the Central Basin. Red clover has two growing seasons. It makes its most vigorous growth from the 1st of April until the 15th of June, beginning to bloom usually in the central parts of the State about the 15th of May, and attaining its full inflorescence about the 1st of June. After this, unless depastured by stock or cut for hay, the heads begin to dry up, and stems and leaves begin to fall, forming a mat upon the land. Sometimes this mat is so thick as to catch and concentrate the heats of summer to such a degree as to scald the roots and destroy the clover. Usually it is best after clover has attained its full bloom, either to cut it for hay, or pasture with stock until about the first of July. When the stock is removed, or the clover hay cured and taken off, and there is rain enough, a second crop will spring up from the roots. This second crop is the most valuable for seed, the seed maturing about the last of August, and sooner, if there be copious rains. To make the most abundant yield of clover for grazing, it should be allowed to grow all it will, but never let it make seed, always grazing it down when in full bloom. When grazed down, take off the stock until it blooms again. Several successive crops may thus be made during the summer. The crop of August is unfit for grazing, the large quantity of seed having the effect of salivating stock to such a degree as to cause them to lose flesh.

It is a fact, well attested by English writers, and by observant farmers of this country, that when clover has been frequently sown upon the same land, it not only fails to produce a heavy crop, but fails to appear at all. The land is then said to be "clover-sick." The remedy for this is by extending the number of crops in the scale of rotation, so that clover will not

come so often upon the same land. By Liebig, clover-sick land is supposed to be caused by the roots of clover impoverishing the subsoil.

Clover has no superior as a grazing plant. When in full vigor and bloom, it will carry more cattle and sheep per acre than blue-grass, Herd's-grass, or orchard-grass. After it has been grazed to the earth, a few showery days with warm suns will cause it to spring up into renewed vitality, ready again to furnish its succulent herbage to domestic animals. Though very nutritious and highly relished by cattle, it often produces a dangerous swelling called hoven, from which many cows die. When first turned upon clover, cattle should only be allowed to graze for an hour or two, and then be driven off for the remainder of the day, gradually increasing the time of grazing, until they become less voracious in their appetites, never permitting them to run upon clover when wet. Clover made wet by a rain at midday is more likely to produce hoven than when wet by dew. This is because when wet by rain at midday, or after the stalks and leaves are heated by the sun, when taken into the stomach of a cow, this heat generates fermentation much sooner than when the herbage is cool, though wet with the morning dew. Cattle are more easily affected by clover than horses, because being ruminants, they take in the clover rapidly, filling the stomach at once, without chewing. Digestion is for the time checked, and a rapid fermentation sets in. The remedy found most effective for hoven is to stick a sharp pointed knife about six inches in front of the hip, to the left side of the backbone, and far enough from it to miss the spinal protuberances, and in the thinnest part of the flank. A cow should never be run when affected with hoven, as this treatment only intensifies the pain without affording relief.

Stock should never be turned upon clover until it blooms. The practice of many of our farmers, to turn all the stock upon a clover-field early in April, is very destructive. The crown of the clover is eaten out, causing it to perish. The tread of heavy cattle has the same effect.

As a soiling crop red clover is excelled by no crop grown within the State. The practice of soiling in thickly-settled

communities is one much commended by agricultural writers. An half-acre of clover will supply one cow throughout the months of June, July and August, if cut off and fed in a stall, while twice the amount in pasture; according to some English experimenters, will barely subsist a cow during the same period, and this will depend, of course, upon the luxuriance of the growth. Soiling (that is cutting the grass and feeding it green) is a very desirable practice, near small towns, where many persons own small lots, and desire to keep a milk cow. No other grass, perhaps, will produce a larger flow of milk.

NUTRITIVE VALUE AND CONSTITUENT ELEMENTS OF CLOVER.

The nutritive value of clover was long known by feeders before chemical research demonstrated the same fact. It contains, when cut in bloom, nearly 4 per cent. more nitrogenous food than timothy, and $4\frac{1}{2}$ per cent. more than blue-grass. According to Professors Wolff and Knop, in its green state it contains 800 parts in 1,000 of water, about 100 parts more than timothy, and 37 parts in 1,000 of albuminoids or flesh-formers. When made into hay, cut when in bloom, and well-cured, red clover contains 134 parts in 1,000 of albuminoids, but cut when fully ripe only 94 parts. The albuminoids contains about 16 per cent. of nitrogen. Timothy hay has 9.7 per cent. of flesh-forming matter, and therefore, contains less nitrogen, in the proportion of 15 to 21, than clover hay. Barley has 10 per cent. of albuminoids, Indian corn 10.7, rye 11, oats 12, clover 13.4 per cent., so that it appears clover hay will furnish more muscle-producing or nitrogenous food than either corn, rye, oats, or timothy, which gives strength to the statements of many practical farmers, that a crop can be made by feeding clover hay alone to the working animals, and they will keep up under it.

Professor Way gives the following analysis of the red clover when green :

	<i>Per cent.</i>
Water.....	81.00
Albuminoids.....	4.27
Fatty matter.....	.69
Heat-producing.....	8.45
Woody fibre.....	3.76
Ash.....	1.82

One hundred pounds dried at 212° F. gives the followin

	<i>Per cent.</i>
Albuminoids or flesh-formers.....	22.55
Fatty matter.....	3.67
Heat-producers (starch, sugar, gum, etc.).....	44.47
Woody fibre.....	19.75
Ash.....	9.56

The proportion of fat in the various vegetable products is given in the following table, taken from Prof. S. W. Johnson's "How Crops Grow":

	<i>Fat—Per cent.</i>
Meadow-grass.....	0.8
Red clover (green).....	0.7
Meadow hay.....	3.0
Clover hay.....	3.2
Wheat straw.....	1.5
Oat straw.....	2.0
Wheat bran.....	1.5
Potato, Irish.....	0.3
Turuip.....	0.1
Wheat kernel.....	1.6
Oat kernel.....	1.6
Indian corn.....	7.0
Pea.....	3.0
Cotton-seed.....	34.0
Flax-seed.....	34.0

It appears from this table that clover hay has not quite one-half the fat of Indian corn, but having more albuminoids it has

nearly 3 per cent. more nitrogenous food. Both should be fed together, the clover to give muscle and the corn to give fat. It also appears that the clover hay is richer in fat than meadow hay.

EFFECTS OF CLOVER UPON SOILS—MANURE FOR.

Numerous facts have taught the farmers of every country where agriculture has flourished, that in many cases the value of the after-crop depends upon the preceding crop. In other words, a proper rotation is necessary antecedent to successful farming. The cultivation of some crop with extensive root ramifications will prepare the soil for the subsequent growth of a cereal. But the farmer should not deceive himself. Every crop takes away a part of the available plant-food, and the field has not increased in fertility, but the plant-food has been made more rigidly effective for the production of a crop. "The physical and chemical condition of the fields has been improved, but the chemical store has been reduced." "All plants," says Liebig, "without exception, exhaust the soil, each of them in its own way, of the conditions for their reproduction."

A field, then, which produces more kindly after rotation, is not necessarily more fertile, but is in better *physical condition*. It has already been mentioned, that the mechanical effects of clover upon soils is not the least among its valuable properties. The reaction rendered possible by the penetration into the soil of the long tap-roots, and the effect of the dense shade upon the land have a tendency to increase the productiveness, but may not add to the fertility of the soil.

Guano is found, on clayey soils, to largely increase the growth of clover. When used on a wheat field seeded to clover in early spring, a "catch" of clover will be secured on the thinnest spots, and grow luxuriantly. The greatest benefits from an application of guano upon wheat are often obtained in this way. A good stand of clover, however secured, is the best possible preparation of land for a succeeding crop of wheat. And this arises, not only from the available nitrogen which a clover crop supplies, but from the deep and thorough subsoiling

which is effected by the deep, penetrating tap-roots of the clover. They often descend to the depth of four feet in search of food, while its broad leaves "absorb carbon from the atmosphere, changing it into solid matter, causing elements in the soil to assume organic forms, rendering them more available as food for other crops." If the soil be robbed of its fertility, the deficient elements must be added before clover will "take."

The best method of pasturing is to wait until about the last of May, when the clover is in bloom, then turn on stock and pasture during the months of June and July, alternating every two weeks with other clover fields, if possible, and turning off the stock the first of August, and allowing the second crop to come forward for seed.

SAVING CLOVER HAY.

The precise period of mowing clover for hay is a question about which there has been much discussion. All will agree that it should be mowed at the time when the nutritive elements—those elements which give strength and produce flesh—are at their maximum. Those who are in the habit of feeding stock find that clover cut about the time of full bloom, when a few of the seeds begin to dry up, and just as the reproductive functions are being brought into play for the maturing of seed, will, pound for pound, produce more fat and muscle than that cut at any other time. The only art in curing hay is to retain as many of the life-giving constituents in it as possible, or to preserve it as near as practicable in the same condition in which it is cut, with the water only abstracted.

The plan generally adopted is to mow the clover in the morning and let it lie in the sun several hours until a wisp, taken up and twisted, will show no exudation of moisture. It is then thrown up into small cocks, say four feet in diameter and four feet high. In these, unless there is appearance of rain, it is allowed to remain for a day or two, when it may be hauled to the barn and stored away without danger of damage. Care should be taken not to let the dew fall upon it as it lies scattered by

the mower. The dew of one single night will blacken the leaves and destroy the aroma for which good clover hay is so much prized.

Another plan practiced is to mow it and let it lie just long enough in the sun to wilt, and then wagon it to an open house and lay it upon beams or tier-poles, where it can receive the free action of the air. After a few days it may be packed down without any danger of fermenting. Cured in this way, in the shade, it retains its green color, is fragrant, and makes a most excellent feed. The only objection to this plan is the great amount of room under cover required for curing, and the additional burden of hauling while green.

Another plan is to haul it up as soon as it wilts, using about half a bushel of salt to the cured ton of hay. A layer a foot or more in thickness may be laid down, over which salt is scattered pretty freely, then another layer and salt, continuing to repeat the operation until the space set apart for hay is filled. A rapid fermentation will ensue, and the hay will be cured by the heat of this fermentation, the salt acting as a preventive against putrefaction. Instead of salt, layers of wheat straw can be substituted. By using straw the clover may be put up in the field. The quantity of straw to be used in the rick or stack depends upon the moisture in the clover—the greener the clover the thicker should be the straw. The straw will act as an absorbent, and during the process will itself be greatly increased in value as food for stock, having imparted to it the flavor and aroma of the clover plant. All the wheat straw on a farm could be utilized in this way, and the amount of manure in the farmer's barn largely increased.

Still another method of curing clover hay is the one practiced in Ireland. The *Irish Farmers' Journal*, in giving an account of this process of curing clover hay, says:

“The clover intended for hay is mown and left to lie in the swath until 4 o'clock in the afternoon of the following day to dry. Of course these swaths are twelve or eighteen inches thick. They are then raked together in small shocks, which are afterwards made into larger ones, such as would require six

or eight horses to draw. Two or more men are kept upon the large ones tramping them down, so as to make them more compact and induce a more speedy fermentation. If the weather is warm, fermentation will begin in a few hours, as will be known by the honey-like smell. When a proper fermentation has begun, the cocks, on being opened, will appear brownish and may be spread. After drying, it may be carried to the hay loft without any danger of a second fermentation."

It should always be borne in mind that clover hay will not shed rain. When stacked out in the field, it should either be thatched or have a thick top-covering of wheat straw or other hay. The tedder is thought by many to be indispensable in saving good clover hay. Unquestionably it is of great service, and the hay made by the use of the tedder in dry, hot weather is superior to that made without; but good hay can be and is made by many farmers who never saw a tedder. Clover hay is more difficult to cure than hay from any of the real grasses, and this arises from the fact that it contains more water than other grasses in the proportion of eight to seven. For this reason, also, it is more difficult to keep, being more liable to heat in the mow. It will not bear handling or transportation, and while it will always be a favorite hay for home consumption, it will never be valuable for market purposes. For horses good grass hay is probably better than clover, because it is more digestible, and is not so liable to produce colic. On the other hand, clover is a superior hay for cattle, producing in milk cows a fine flow of milk.

The following table, compiled from analyses made by Wolf, Knop and Way, will exhibit the comparative value of clover and grass hays :

SUBSTANCE.	Water.	Organic matter.	Ash.	Albuminoids.	Carbohydrates.	Crude fibre.	Fat, etc.
Red clover, in bloom -----	16.7	77.1	6.2	13.4	29.9	35.8	3.2
Red clover, ripe -----	16.7	77.7	5.6	9.4	20.3	48.0	2.0
White clover. -----	16.7	74.8	8.5	14.9	34.3	25.6	3.5
Alsike clover, in bloom -----	16.7	75.0	8.3	15.3	39.2	30.5	3.3
Alsike clover, ripe -----	16.7	78.3	5.0	10.2	23.1	45.0	2.5
Orchard-grass -----	14.3	81.1	4.6	11.6	40.7	28.9	2.7
Timothy -----	14.3	81.2	4.5	9.7	48.6	32.7	3.0
Kentucky blue-grass -----	14.3	80.6	5.1	8.9	39.1	32.6	3.1

SAVING CLOVER SEED.

It has often been a matter of surprise that Tennessee farmers have not more generally saved their clover seed. The amount of money yearly paid out for an article which is now considered a prime necessity to good farming, is enormous. Were the lands of Tennessee incapable of producing clover seed, there would be reason for this expenditure. In point of fact, however, no section of the Union will produce, acre for acre, a larger quantity of clover seed. Three bushels per acre have often been gathered, although the usual average is about one and one-half bushels.

As the first crop of clover, coming to maturity in June, will not perfect its seed, it is necessary to take off the first crop, either by feeding or by mowing for hay, and rely for the seed upon the after crop. The quantity of seed of this crop will depend much upon the weather. Should there be much rain or heavy winds, the yield of seed will be small, but when the weather has been fine and calm, and the seed free from dock or other noxious seeds, the crop will be found as remunerative as any other grown by the farmer. A bushel of clover seed will weigh usually about sixty-four pounds, though sixty pounds is the standard bushel in market.

The seed crop of clover should be allowed to stand until the husks have become quite brown and the seeds have passed the milky state. It should then be mowed and permitted to lie

upon the ground until it is well cured. After it is cured rake it up into swaths. Rain will rather benefit than injure it, making it easier to separate the heads from the haulm, which is done by passing through an ordinary wheat separator. A clover-huller attachment is adjusted to the separator below the vibrator, which hulls the seeds, and they are separated from the chaff by the fan, care being taken to shut off as much air as possible by closing the sliding doors.

The crop of seed can be largely increased by mowing or feeding off the first crop of clover about the first of June, and then top-dressing with stable manure. The earlier the first crop is cut the larger will be the crop of seed. By treating the clover-fields in this way, as much as three bushels of seed have been obtained from an acre. Uplands will yield more seed than bottom lands, but they should be enriched by a liberal application of manure. About the first of September is the time to mow for seed, and the straw will thresh all the better for being exposed to the weather for three weeks. The threshing is usually done in the field, though the haulm may be hauled up after being thoroughly dry, and stacked with a good straw covering, or else stored away under shelter on a good tight floor until it suits the convenience of the farmer to thresh. Care should be taken not to run over or tramp upon the clover after it is dried, as many seeds are thus shelled out and lost. The better plan is to haul to the thresher just as soon as the straw is in a proper condition to thresh. This will save the trouble and expense of stacking.

Some farmers prefer to sow in the chaff, believing that a better stand of clover is thus secured. Usually about thirty bushels in the chaff are considered equivalent to one of cleaned seed. Of course this will depend greatly upon the yield of seed, and experiments ought to be made to determine the relative amount to sow when in chaff.

CLOVER AS A PREPARATORY CROP FOR WHEAT.

No question at the present day pertaining to agriculture is more deeply interesting to the farmers of Tennessee than how to increase the yield of the wheat crop per acre, for upon this

depends the profits of this standard crop, one probably more generally grown in the State than any other. It has also been noted that a soil well suited to clover is generally well adapted to wheat, but not until the painstaking investigations of Dr. Voelcker, of England, was the fact established that the clover plant, by increasing the amount of available nitrogen in the surface soil, is the very best forerunner for wheat, unlocking, as it were, the elements in the soil necessary to a full and perfect development of the wheat crop.

Prof. Way has established the fact that the carbonate of ammonia of rain water and of manures are so absorbed and so firmly fixed by the soil that no free ammonia can be present in it. Neither pure nor carbonic acid water can extract this fixed ammonia from the soil. It must be extracted by the roots of plants. A plant, therefore, with extensive root ramifications, such as clover, will extract a much larger quantity than those plants with feebler roots. The clover roots bring this ammonia or nitrogen to the surface, and on their decay these nitrogenous matters are converted into nitrates in which the wheat plant finds a most congenial food. In addition to this, the leaves formed by clover contain a large amount of nitrogenous matter, and these are dropped upon the surface, increasing the amount of nitrogen available for wheat or other crops.

ALSIKE CLOVER—*Trifolium hybridum*.

This species of clover was introduced into England from Sweden, hence it is sometimes called Swedish clover. It gets the name of Alsike from the parish of Alsike, in the province of Upland. It is a perennial, found wild throughout many parts of Sweden, Norway and Finland.

Alsike clover, as compared with common red clover, has a slenderer stalk, narrower leaf and paler-colored flowers and foliage. The flower stalks are longer, and the blossoms more fragrant and sweeter to the taste. When first open, the blooms are but faintly tinged with pink, subsequently they deepen into a pale red, and stand up. When the period of flowering passes,

the heads droop and turn brown. The seed pods contain three or four seeds, which are kidney-shaped, and from dark green to violet color, and considerably smaller than the seeds of red clover.

This clover does not make much growth the first year, and attains full growth only in its third year. It yields less than the red clover, and has but little or no aftermath. It is hardier and sweeter than red clover, and being a perennial, is more lasting, and it makes a finer hay.

Wherever it has been tried, experience has taught that it is best to seed it down with red clover, or some grass, preferably orchard-grass, for the reason that it does not occupy the ground the first year, and is liable to fall and lodge badly if sown alone. I have noticed that it is much frequented by bees. It does not stand the long, dry summers of our latitude well, but seems to like cool, moist regions.

As compared with red clover, the hay is richer by two per cent. in flesh formers—both cut in bloom. The analyses of both, as given by Professors Wolff and Knop, show:

<i>Red Clover—</i>	<i>Per cent.</i>
Flesh formers.....	13.4
Heat-producing substances.....	29.9
Crude fibre.....	35.8
Fat.....	3.2
Ash.....	6.2

<i>Alsike—</i>	<i>Per cent.</i>
Flesh formers.....	15.3
Heat-producing substances.....	29.2
Crude fibre.....	30.5
Fat.....	3.3
Ash.....	8.8

The great difference in the amount of crude fibre is noticeable, and shows decidedly in favor of Alsike clover.

SAPLING RED CLOVER—*Trifolium erectum*.

This is precisely the same plant as the common red clover, and is used in the same manner and for the same purposes. The only difference in it is, that the stems being stouter, it is not liable to lodge, but stand erect, and so be in a better condition to mow, and admits the sun to its roots better. As to which may be preferable is a mere matter of taste or prejudice. Either is good, the sapling clover being about two weeks later.

CRIMSON CLOVER—*Trifolium incarnatum*.

An analysis of the hay cut in bloom, as made by Wolff and Knop, shows :

Flesh formers.....	12.2
Heating properties.....	30.1
Crude fibre.....	33.8
Fat	3.0
Ash	7.2

It is said to be earlier than lucerne or the common red clover. It may be sown upon wheat or grain stubble in the fall, the land being simply harrowed and seed sown.

Few things, it is said, in the vegetable world, present a more beautiful sight than a field of crimson clover in full bloom. It is not grown to any extent in this State, a few bunches appearing sometimes in fields with other clover. Its chief value is in its quick return. Sown in autumn it may be mown early in the succeeding spring, and so meet any scarcity of provender.

ALFALFA—LUCERNE—*Medicago Sativa*.

This is, beyond doubt, the oldest cultivated grass known, having been introduced into Greece from Media 500 B. C., and the Romans, finding its qualities good, cultivated it extensively, and by them it was carried into France when Cæsar reduced

Gaul. It is emphatically a child of the sun, and revels in a heat that would destroy any other species of clover. But cold and moisture are hurtful to it. On the rich, sandy lands of the South it is invaluable, and will grow luxuriantly, making enormous yields of hay. Its nutritive constituents are almost identical with red clover, but it has one property not possessed by the latter, and that is, it is perennial. It does not stool as freely as red clover, and therefore must be sown rather thicker. It will continue to furnish green pasturage later than red clover.

It does not grow well on any soil that has a hard pan, nor on thin soils. To secure a stand, the ground must be in a thorough state of tilth, well pulverized and mellow. A want of attention to this requisite has caused many to be disappointed in the result. But in well-prepared, rich, gravelly or sandy loam, it succeeds remarkably, sending down its long tap-roots many feet into the subsoil, pumping up moisture from below, and thus will thrive when all other plants are drooping. In this respect it is far superior to clover. For the latter, a suitable surface soil is of equal importance with the subsoil, but for Lucerne a suitable subsoil is absolutely necessary, as the roots are not fibrous, only rootlets shooting off from the main tap-root. This tap-root grows to be as large as a carrot. This enormous quantity of roots permeating the ground to the depth of several feet, necessarily prepares the land for increased production, the leguminous plants deriving the larger part of their sustenance from the atmosphere, and storing it in the roots; so that, as a fertilizer, it stands deservedly high. The soil is not only fertilized to the amount of several tons per acre, but it is mellowed from the mechanical displacement of the soil and the admixture of decayed vegetable matter. As a preparation for wheat it is equal to clover, and for corn better. Besides, a large amount of the leaves is necessarily strewn on the ground, and they shade it effectually.

The seed of Lucerne is yellow and heavy, when good. If brown, it has received too much heat in the mow, and if light-colored, it indicates that it was saved too green. And the same precautions are necessary to be observed in regard to red clover. The time of sowing is the same with the other species of clover,

that is, spring-time. It should be sown in drills, and cultivated the first year, so as to keep down the weeds. It is easily smothered.

It derives its name, *Alfalfa*, from the Chilians. It grows spontaneously all over Chili, among the Andes, as well as on the pampas of that country, and of Buenos Ayres. The French and Spanish settlements of the Southern States adhere to it, and cultivate it in preference to all other forage plants. It would be a good addition to the farms of West Tennessee, especially in the sandy bottoms. It would also thrive upon the alluvial bottoms of any part of the State where the sun has fair play on the ground.

When properly managed, the number of cattle which can be kept in good condition on an area of *Lucerne*, during the whole season, exceeds belief. It is no sooner mown than it pushes out fresh shoots, and wonderful as the growth of clover sometimes is, in a field that has been lately mown, that of *Lucerne* is far more rapid. *Lucerne* will last for many years, shooting its roots—tough and fibrous almost as those of liquorice—downwards for nourishment, till they are altogether out of reach of drought. In the driest and most sultry weather, when every blade of grass droops for want of moisture, *Lucerne* holds out its stem fresh and green as in the genial spring.

Although so luxuriant in France, it will not flourish in England for the want of sun. It has generally failed in the Northern States for the same reason, superadded to the cold, while in the South it is a fine, thrifty plant. It has been fully tested in Georgia and Alabama, and has given universal satisfaction. Horses there, it is said, require no other food when not constantly engaged in work. Five tons of good hay have been made to the acre. It is estimated that five horses may be supported during the entire year from one acre of it. It is ready for the mower a month before red clover, and springs up long before the usual pasture grasses. In saving it for hay, care must be exercised, as in red clover, not to expose the plant too long to the sun, as it will shrivel and dry up the leaves, and they will be lost. The time for cutting is when it is in full bloom, as in red clover.

Occasionally it is attacked by an insect, when it begins to turn yellow, then it should at once be cut, as it will quickly dry up otherwise. Owing to the scarcity of seed, and the small amount cultivated, it is quite expensive, but the farmer can test it on a small quantity of land, and at the same time secure seed for future sowing. The first year it is apt to be troubled by the presence of weeds, but these can be easily exterminated if the precaution is observed to run the mower over it before weeds go to seed. Afterwards no fears need be entertained on that subject.

This plant is well adapted to the use of persons living in small towns or villages, who have a small lot they wish to devote to hay for a single horse or cow. No other kind of clover or grass will equal it in quantity, while the quality is as good as the best.

On the whole, the farmers cannot do better than adopt the cultivation of this grass. It has proved, with all who have tested it, worthy of all the extravagant encomiums bestowed upon it.

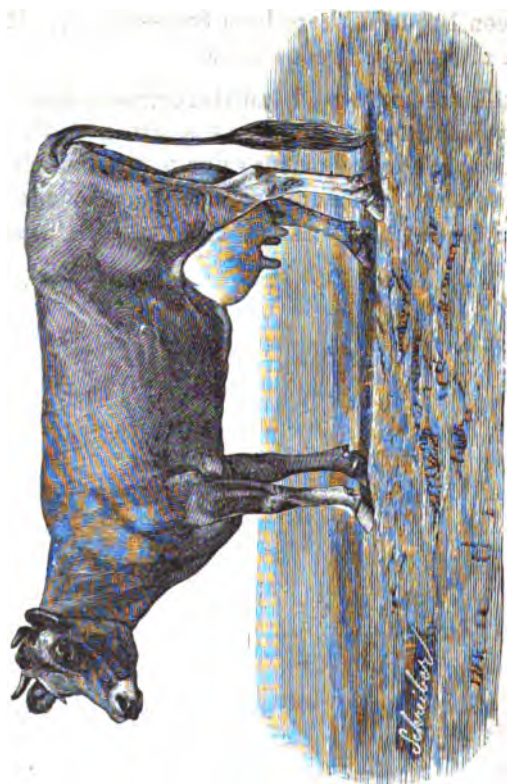
An analysis shows the hay to contain :

Flesh formers.....	14.4
Heating properties.....	22.5
Crude fibre	40.0
Fat	2.5
Ash.....	6.4

It will be seen that in flesh-forming constituents it surpasses red clover by one per cent.

SAINFOIN, OR ESPARSETTE— *Onobrychis sativa*.

Experiments have been made with this grass, and though so valuable in France as to be called sacred, it has not proved a success here. It requires two or three years to arrive at maturity, and during that time has to be watched closely, or it will be choked up with weeds or grasses. It does not yield as much



Jersey Cow, DUCHESS OF BLOOMFIELD (3653).

Test, 20 lbs. $\frac{1}{4}$ oz. in seven days.

Property of CAMPBELL BROWN, Ewell Station, Tenn.

hay as either red clover or lucerne, but is of a very superior kind, and is much vaunted as a good butter-making hay. It does not give cows the hoven, however much they may eat of it. Its seeds are also said to be superior to oats, and more nutritious, and are very fine for fowls, inciting them to lay. It does best on limestone soils, though succeeding well on gravelly or sandy land, and will stand a large amount of heat, though not much cold. It would probably suit the country farther south better than Tennessee; though I have seen it growing in Stewart County, having been brought there by a Swiss family. It would probably grow on all our calcareous soils.

This is an annual, presenting a beautiful crimson flower when in bloom. It is principally valuable as a green food, though the hay is thought to be equal or superior to that made of red clover, but being an annual it interferes more with the operations of the farm, it being necessary to sow it as a separate crop.

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PASTURE GRASSES.

While there are over two hundred varieties of grasses cultivated in England for the use of domestic animals, in the occupied territory embraced within the United States there are not more than twenty-five, although there is a much greater diversity of soils, surface configuration, climate and latitude. The grasses constituting our meadows are nearly all derived from the eastern continent, where the abundance of the rich pasture lands teem with a great variety of nutritious herbage. All the cereals—oats, rye, wheat and barley—are indigenous to the Old World. Indian corn is the greatest and almost the only valuable cereal contributed by the New World to the Old. The great prairies east and west of the Mississippi abound in a charming and luxuriant vegetation, but the supply of food which they afford for the herds grazing upon them, in comparison to the overwhelming quantity of worthless herbage, is very scanty. Exactly the reverse is the condition of the pastures of the Eastern Hemisphere, where almost every plant that springs from the surface of the earth is rich in nutritive elements. The situation of Tennessee being midway between the East and West, partakes of both sections. We have in the State many thousands of acres of wild lands, situated not only on the mountain plateau, but on the highlands of the river lands, called with us "Barrens." These Barrens are covered with a dense growth of timber, and in some sections, where they have not been burned off, with undergrowth of various kinds. Where this undergrowth has been burned off by firing the leaves in the fall and winter, the pastures are as fine as are seen anywhere, not excepting the prairies. It is true there are many species of grasses that are worthless, or that are at least of doubtful value, yet enough of them exist there to make them invaluable to the stock-grower. In the fall of the year these grasses become tall, will turn over and form a roof or covering to young

grass that grows under them all the winter, and stock will paw at it until, the covering removed, they get to the young, succulent shoots thus kept alive throughout our short winters. A detailed description of these wild grasses, while it might interest the student, would be out of place in a work of this kind, intended to be entirely practical; for, however much they may be used in their indigenous situation, there is no probability of the farmer ever getting them transferred to his fields. The grasses we here treat of as pasture grasses, are alone those that will bear sowing in new situations, and to this class we will strictly adhere. For a more detailed description of the others I refer the reader to the work sent out from this Bureau on the "Grasses of Tennessee."

With this explanation we will describe the subjoined.

NIMBLE WILL—*Muhlenbergia diffusa*.

It is hardly necessary to do more than mention this grass, which forms, in many sections, the bulk of the pastures of the woods. It does not grow in fields, but in woods, where, in the fall, after rains have set in, it carpets the earth with living green. Various opinions are entertained as to its nutritive qualities. Some farmers contend that their stock are fond of it, and, on a sufficient range, cattle, horses and sheep will go into the winter sleek and fat from this vigorous grass. Others regard it as well-nigh worthless.

It freely propagates itself in all woods where the covering of leaves is not so great as to exclude the rays of the sun from the soil. Like other grasses, it does best on good lands, and the rich, black, loamy woods in many parts of the State are set with it.

It is said to be an excellent butter-making grass, and gives a particularly fine flavor to this article of food. It has never, to the knowledge of the writer, been sown, though as it produces seed in a limited quantity, there is no reason why it should not be, if it is really a valuable grass.

BERMUDA GRASS—SCUTCH GRASS—*Cynodon dactylon*.

Bermuda grass is a native of the West Indies, and is the principal grass of that torrid country. It has only lately been brought into notice as a valuable pasture grass for this State. In Louisiana, Texas and the South generally, it is, and has been the chief reliance for pasture for a long time, and the immense herds of cattle on the southern prairies subsist principally on this food. It revels on sandy soils, and has been grown extensively on the sandy hills of Virginia and North and South Carolina. From the extreme vitality of its long, rhizome roots, it is very difficult to eradicate when once it gets a good foothold. Occasionally the traveler meets with patches of Bermuda grass in the cotton fields of the South, and it is carefully avoided by the planter, any disturbance giving a new start to its vigorous roots. Some ditch around it, and others inclose it and let shrubbery do the work of destruction. It is used extensively on the southern rivers to hold the levees and the embankments of the roads. It is the only yard grass in that section. It forms a sward so tough it is almost impossible for a plow to pass through it. There is a saying in the South, "that it would take a team of six bull elephants to draw a thumb-lancet through it."

It will throw its runners over a rock six feet across, and soon hide it from view; or, it will run down the sides of the deepest gully and stop its washing.

The parks of the South, set with it, present a very beautiful appearance if kept mown, and its pale green color acts as a great relief to the landscape when burning with the summer suns of the South. Hogs thrive upon its succulent roots, and horses and cattle upon its foliage. It has seed, but is always propagated by dropping cuttings in a furrow two or three feet apart, from the fact that the seed rarely mature, so that practically it may be said to have none. It, however, does not endure a shade, and the weeds must be mown from it the first year.

In some of the worn and gullied fields of Tennessee, on her mountain sides and on the sandy hills of many parts of the

State, the cultivation of this grass would be a grand improvement, making the waste places to bloom where now only sterility reigns. During the winter it, unlike blue-grass, disappears from view, but with the warming influences of the sun it springs up and affords a constant grazing through the spring, summer and autumn months. The farmers of the South, before the war, looked upon it as a curse rather than a blessing, and used every endeavor to destroy it. But a change of opinion has taken place in this respect, and it is encouraged in its growth.

It would be a good grass to mix with blue-grass, as, when it disappears in the winter, the blue-grass and white clover will spring up to keep the ground in a constant state of verdure. It grows luxuriantly on the top of Lookout Mountain, having been set there many years ago. This mountain is 2,200 feet high, and has, as a matter of course, excessively cold winters; so, if it thrives there, no fear need be entertained as to its capacity to endure our climate. Cattle are very fond of it, and will leave clover to feed upon Bermuda. It also has a capacity to withstand any amount of heat and drought, and months that are so dry as to check the growth of blue-grass, will only make the Bermuda greener and more thrifty. The experiment of mixing the two grasses, spoken of above, has been tried with eminent success.

It is also used in the South as meadow grass, but Tennessee has so many other grasses of more value, that it would not be profitable to employ this, other than as a pasture grass.

Where it is indigenous, it has a great reputation as a fertilizer, and many fields so worn out as to be worthless, have been reclaimed by it. The labor of plowing it up is considerable, but the many improved plows of the present day would be easily dragged through it. There is a sacred grass in India called the Daub, and it is venerated by the inhabitants on account of its wonderful usefulness. This is said to be precisely the same as the Bermuda, except the changes made by the difference of climate and soil.

"Bermuda grass well set, which affords the finest and most nutritious pasturage I have ever seen, will keep almost any

number of sheep to the acre—three or four times as many as blue-grass.”

HAIRY MUSKIT — MEZQUITE — MESQUITE — *Bouletoua curtipendula*.

Muskit grass has come into very general use in some parts of Virginia, North Carolina, and to some extent, in Tennessee, and where used, has given much satisfaction. It is the grass of the northern and western prairies, and is very nutritious. In the absence of grasses better suited to this climate, the muskit might become a very popular grass, but such is not the case. Great quantities of it are annually cut and sold as prairie hay. It would be well for some enterprising farmer to experiment with it.

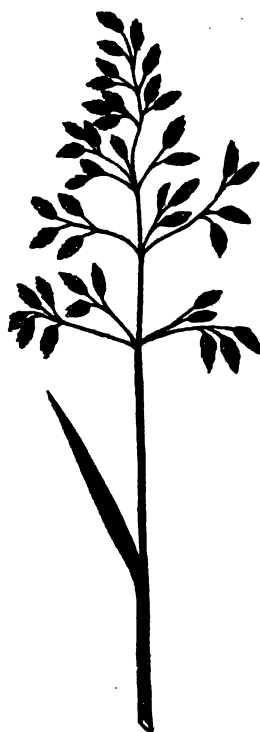
ANNUAL SPEAR GRASS—GOOSE GRASS—*Poa annua*.

This is one of the species of the valuable genus *poa* to which blue-grass belongs, and is a very common grass on all our swards, and known as goose grass. It is so very like blue-grass that, to a casual observer, it would be taken for it. But the florets are not webbed, and in blue-grass the roots are creeping, while this is tufted. It is a valuable grazing grass and sows itself. It is a common pasture grass of the Northern States, and is highly prized. It flowers through the whole summer, unless dried up by a drought, to which it easily yields. It forms the principle grazing of the Unaka Mountains in Tennessee.

According to Prof. Way, this grass is less nutritious than blue-grass when green, and more nutritious when dry.

WOOD MEADOW GRASS—*Poa nemoralis*.

This grass grows in moist, shady woods, is rank and luxuriant, and is, like the other *poas*, greatly relished by stock. It will thrive well in thickets and barrens, and is an early grass. It has been treated of under the head of meadow grasses.

BLUE-GRASS—*Poa pratensis*.

This is the king of pasture grasses in the Central Basin of Tennessee, and on soils suited to its growth it is useless to attempt the cultivation of any other kinds, except as auxiliary to this. It is valuable both for summer and winter pasturage, and no farmer occupying soils suited to its growth is justifiable in being without it. It is easily started, and the seeds are readily procured, and once started, it is perennial. No amount of pasturing is sufficient to destroy it utterly, and, though eaten until no appearance of it is seen on the ground, with rest for a few days, the earth is again carpeted with its soft green foliage as luxuriantly as ever. "Whoever has bluegrass has the basis for all agricultural prosperity, and that man, if he has not the finest horses, cattle and sheep, has no one to blame but himself. Others in other circumstances may do well, he can hardly

help doing well if he will try."

Its parentage is claimed by many States, and is probably indigenous to some of them, though some authors says it was introduced from Europe. Let that be as it may, it grows readily in all parts of the United States north of latitude 33°, and lower down on suitable soils. It flowers in earliest summer, and gives a rich pasturage, except in the driest months, all the year. It varies in size in different localities, according to soil and climate. From the unexampled success its cultivation has met with in Kentucky, it has acquired the name of Kentucky blue-grass. The June or wire-grass of the North is very much like it in general appearance, but the seed stalk is flattened, and for this reason the botanical name, *poa compressa*, is given. The seeds are not so fuzzy as those of the Kentucky blue-grass.

In all the middle portions of the United States it forms the principal constituent of the turf. In some sections it has been used as a hay, and from the analysis hereunto appended, it is full of all the constituents of nutrition. But it is not a success as a meadow grass, its chief excellence being exhibited as a pasture grass. It endures the frosts of winter better than any other grass we have, and if allowed to grow rank during the fall months, it will turn over and hide beneath its covering the most luxuriant of winter croppings. Many farmers pass their stock through the entire winter on it alone, feeding only when the ground is covered with snow.

As a lawn grass it stands pre-eminent among all others, its rich Paris green foliage, its uniform growth, and its constant verdure making it beautiful both summer and winter.

A farm well set in blue-grass will yield at least ten dollars per acre in grazing, and yet men who have farms with all the constituents necessary to produce the best of grass, will persistently wear them out in cultivation from year to year, with less net receipts by far than the yield of a pasture. In the work on Wheat Culture, issued from this office, it has been shown that a large proportion of Middle and East Tennessee abounds in limestone rocks, in fact, it underlies the Basin of Middle Tennessee and forms most of the foundations of the Eastern mountains. The blue-grass of Kentucky is made from soil produced by precisely the same strata of rocks seen here. Any farmer having land showing an outcrop of limestone with a grayish colored subsoil, may be assured he has the necessary soil. These rocks are looked upon as a curse, yet, without their presence, we could not have the magnificent parks of blue-grass seen around.

Blue-grass lands do not exist everywhere in the United States, and that should increase their value. They will be in demand, and that soon. The wild grasses that now are such an attraction to immigrants, on the table-lands of Tennessee, will ultimately be exhausted by the increase in population, while the demand for food and every variety of domestic animals will be proportionably augmented according to the increase of the population. Then every acre of land that will produce blue-grass

will be in active demand, and will be devoted to stock raising, for which it is so well adapted, and sheep and cattle will then flock every hillside.

The fame of the Kentucky blue-grass is so great that the majority of people suppose Tennessee cannot produce it so well, and they demand practical evidence of the fact. We have that very evidence here spread out before our eyes in the magnificent pastures of those who have adopted the proper management. Kentucky has famous pastures, because, in the outset of her cultivation of the blue-grass, a system of management was adopted that proved a success. That system has been thoroughly tested both in Kentucky and in some counties in Tennessee, and no one has made a failure who has attempted it. Those who have put themselves to the trouble of learning that system, and putting it in practice, have made as good grass as can be made in Kentucky or elsewhere. As in other crops, the quantity and quality of grass are in exact proportion to the care and management bestowed upon it, and the sod is as good, the blades as wide and long as can be seen anywhere, but this all depends on the skill and attention of the farmer. Some will sow a lot and then put in cattle, horses, sheep and hogs to keep it eaten to the ground throughout the year. Under such treatment the grass disappears, and such farmers conclude their soils are not adapted to grass. Let the grass get a vigorous start, protect it from stock for the first year, and fertilize it with stable manure, or some of the superphosphates, and be sure not to overerowd the pasture with stock. This is the true secret of having good pastures.

Dr. F. H. Gordon, of Smith County, spent years in studying the habits of the blue-grass, and finally succeeded in giving the best instructions for securing a stand :

"Some seventy years ago," he says, writing in 1871, "two young men named Cunningham came from the south branch of the Potomac, in Virginia, to Strode's Creek, in Bourbon County, Kentucky. They had studied and practiced the blue-grass system on the Potomac. They jointly purchased two hundred acres of land on Strode's Creek, and sowed the whole tract in timothy and blue-grass. In a few years their whole

tract was covered with a luxuriant coat of grass. They had brought with them the seed, on a pack-horse, all the way from Virginia. Their farm soon attracted the attention of their neighbors who began to visit, and learn how to manage grass. In 1835 I, too, went to see the Cunninghams and many other farmers in the blue-grass region, in order to learn the system. I devoted many weeks to the study of the system—going with the best farmers over their farms and seeing their management, asking many questions and writing down their answers. Then, the Cunninghams, like many others, had grown to be wealthy on the profits of the blue-grass. One of them, Robert, then had two thousand acres in blue-grass and Isaac had three thousand. Nearly all the farmers I visited owed the luxury of their blue-grass to the direct instruction of the Cunninghams. To me it was a feast to travel over and view the fine sod of grass on the first two hundred acres which had caused the whole blue-grass region to become so beautiful, prosperous and wealthy.

While learning the blue-grass system, I saw in every neighborhood that those who had studied the system closest had the best pastures invariably. You can see in all that region of blue-grass some farms where all the lots look like some of ours in Tennessee, which are gnawed all the year round by calves, sheep and geese. This is because the owner does not think enough about its management. He does all the work and incurs all the expense necessary to make the richest pastures, and then wastes it all by bad and thoughtless management. But there are some farmers in almost every county in Tennessee who well understand the Kentucky system. Those who intend to sow grass may learn the system from them. What a scene of comfort, beauty, luxury and wealth, will this whole Middle Tennessee present, when it shall be covered with the richest blue-grass! Such will be the future of this fine country."

"Blue-grass will always pay a good profit. Every acre set in it will pay its taxes and a good profit besides. We now till too much land. We ought to till less and make more grass. Let not an acre be idle. There is our true interest. Cotton, tobacco, rice, hemp and sugar need laborers, but grass does not.

If we sow our lands in grass we can do without so much labor. The indisposition of farmers to take advantage of experience is shown in the following case, which is in point :

"I know a rocky lot of about six acres which I myself sowed in 1835. During last year (1870) it afforded a profit to the present owner of full \$10 per acre. The owner has no grass on the balance of his land, and does not intend to have any. He has lived during his whole life in sight of rich pastures of blue-grass, and knows that his whole tract will produce as good grass as those pastures, yet he will not sow grass. The reader will say that this farmer, with his six rocky acres of blue-grass, is a singular man. But he is not very singular, because hundreds of farmers here know just as well the value of blue-grass as he does, and yet they do not sow it."

It is generally conceded that the lands most productive of blue-grass are the calcareous soils. Lime is a natural stimulant to it, and it flourishes best where natural supplies of this salt are found. Go into a pasture that has an occasional outcropping of limestone, and the sprigs of grass surrounding the rocks will be found more luxuriant than anywhere else. Our lower Silurian formation, then, wherever found, may be safely sown in this grass. The Basin of Middle Tennessee, and the valleys of East Tennessee, are all well suited for this grass, and I have seen some good sods in Carroll County, West Tennessee. It also grows upon many places amongst the hills of the rivers, though not so luxuriantly as in the black loams of the Silurian and Devonian formations. Lime, though a great stimulant to its growth, is not an essential ingredient in the soil. Blue-grass will always grow well under walnut and locust trees.

We have in Middle and East Tennessee the same character of soil that exists in the blue-grass country of Kentucky, and, owing to our milder climate, can produce a better winter pasturage than can be produced in the colder climate of Kentucky. Little land exists in Tennessee but what will produce this grass profitably.

Select the lot to be sown, and clean off all brush, leaves and briars. If it cannot be done with a stalk-rake, use hand-rakes,

as the seed must come in contact with the soil. Seed sown on a bed of leaves will soon germinate, but the rootlets, being unable to burrow in the soil, will quickly parch up and die. If the land is thickly covered with trees it will not thrive well, therefore it is necessary the timber should be thinned out. Leave the tallest trees that are really the most valuable, taking off the low, bushy kinds that make too much shade. It is an admitted fact that blue-grass does better in partial shade than where there is none. It does not endure a drought as well as some other grasses, and, consequently, some degree of shade is essential to protect it from the scorching rays of midsummer.

So many seasons have been recommended as the proper time of sowing, that it may be said each one, under favorable circumstances, is a good time. One Kentucky farmer says: "Any time in the winter, when snow is on the ground, sow broadcast from three to four quarts of seed to the acre. With the spring the seeds germinate, and are very fine and delicate in the sprouts. No stock should be allowed for the first year, nor until the grass seeds in June for the first time the second year. The best plan is to turn on the stock when the seeds ripen in June. Graze off the grass, then allow the fall growth and graze all winter, taking care never to feed the grass closely at any time."

Another authority says: "Follow nature and obey her dictates. The seeds ripen in June, and are scattered by the winds and rains as soon as ripe; therefore sow the seeds as soon as they can be gathered."

This plan might be a proper one in a colder or moister climate than ours, but here it would result in the grass being often dried up by the droughts that are almost invariable in the latter part of summer.

Many sow, as stated in the above quotation, on winter snows, and that is a very good plan, but care should be observed to have the ground free from leaves before the snow falls.

There are others who sow in the latter part of February or first of March, and this sometimes does as well as any, provided time is given for the grass to get sufficient hold to resist

the withering effects of the summer's drought. The main care to be taken is to get the grass large enough to live through freezing or dry weather. It will resist the effects of frost better than heat, however, and, taking this into consideration, the most approved time of sowing is in the latter part of August or first of September. If sown at this time the autumnal rains will germinate the seed; and besides, at this season there is comparatively little trash on the ground, the leaves having not yet fallen. The ground being prepared, the seeds are sown broadcast, at the rate of one bushel per acre, and the sower should be followed by a harrow, or, if the ground is very loose, with a stiff brush. This will give them a sufficient covering. It is a fact, demonstrated by actual experiment, as shown in one of the tables herein contained, that grass seeds will vegetate best at a depth of one-quarter of an inch. It may be supposed that, with no more covering than will be given by a harrow or brush, a great many seeds will be uncovered. This is very true, but in one pound of blue-grass seeds (clean seed) there 3,888,000 seeds. By a computation every square inch of surface contains from ten to twelve seeds. With this amount on the surface, one need scarcely fear a stand, when, if one or two take root, there will be in a year an excessively close turf.

There can be but little difference of opinion in regard to the treading of stock after sowing. All writers and farmers agree that for one year, at least, it should be kept from all stock. After that there is some difference.

Dr. Gordon, who, as before stated, paid more attention to it than any one else in the State, adopted a plan of management that has been repeatedly tested, with uniform success. It was this:

He sowed, either in the autumn or spring months, indiscriminately, as suited his convenience. He usually sowed with rye, wheat or barley, if sowed in an open field, but if in a woods-lot, he sowed with rye, or after a crop of millet. At any rate, the soil must be well cleaned off and broken up, as well as the nature of the land permits, then, after the grain is sown the land is harrowed, and if possible rolled. After this the grass seeds were sown and brushed lightly. Immediately afterward, all the

cattle, horses and sheep were turned in that could be secured. If there was not enough on his place he borrowed his neighbor's stock, and let them run on it until the ground was well packed all over the surface, and then, and not until then, were they removed. If after millet (and that is greatly recommended, as it destroys more effectively than anything else all weeds), harrow about the first of September thoroughly, sow the seed, brush as before, and then turn on the stock. If it is desired to sow in the spring, in the latter part of February or early in March; if not practicable sooner, harrow the grain field, the ground having been well prepared in the fall sowing, sow the seed and then turn stock on the wheat, rye or barley, as the case may be. Oat land may be sown in the same way. The treading of the stock packs in the seeds and prevents the grass from drying up in the summer heats, or freezing out in frosts. Dr. Gordon considered an open, loose, porous surface to be unfavorable to the safety of the young grass, but if packed as directed, the grass will spring quickly up, get a firm hold, and the loose condition of the sub-soil will favor the transmission of the roots to a good depth.

The after treatment is simple, and that is to allow no stock on during the first year, but as soon as the seed stalks begin to shoot up the next year, pasture it so closely that it cannot go to seed.

Dr. Gordon differs in this respect from other authors, who allow it to seed one time for purposes stated below. He would not let it seed at all. His great success in this branch of agriculture will, in every place where he is known, give weight to his authority.

Others say no stock should go on it for at least two years, or at least until after the first seeding, which will take place in June of the second year. Some of the best blue-grass lots in Middle Tennessee have been started by following either of the above plans. Of one thing there can be no doubt, and that is the ground should not be well broken up. On the surface it should be as firmly packed as possible to secure a perfect stand, and form a perfect turf. When the surface is too loose, the grass easily dries up and is much easier frozen out, the seeds not going into a germinating depth. Under favorable weather,

seed sown in the spring on a crop of oats will do as well as fall sowing. What is meant by favorable weather is that no unusual dry weather supervenes. But there is always the risk of meeting with unfavorable weather in spring sowing, and on that account we would recommend sowing in autumn. But it is better the sowing should take place as early in the fall as the weather will permit, or, indeed, the latter part of summer, if there is a proper degree of moisture in the soil. Some farmers sow a limited amount of seed daily, and over the same surface sprinkle shelled corn, then turn on their hogs. They root in search of the corn, and thus plant the seed, doing the work of plow and harrow.

This, to say the least, is a slovenly plan, and though possibly securing a good stand, the ground is so roughened it can never make a beautiful pasture.

If the land is loose, as some soils are, it will answer a very good purpose to scratch up the surface well with a sharp-toothed harrow, and this is especially the case where the roots of undergrowth exist to a great extent.

AFTER TREATMENT.

Of one fact there cannot be a doubt, and in this lies the whole secret of having remunerative pastures of blue-grass; and that is, do not pasture it to death. It is true it will stand almost unlimited grazing, but there is a point beyond which it will cease to be profitable, and that limit should never be passed. The better plan is to have the lots divided and allow the stock on one until it is cropped down, and then, when no longer any pickings can be taken from it, do not allow the stock to continue to tread it, simply to have them on a grass lot. It will not only do the stock no good, but, by constant tramping, the grass is unable to throw up any foliage, and in time it will die, for the roots must draw some nourishment from the atmosphere, or they will perish. Allow the grass to recuperate by changing the stock from one pasture to another, and *never overstock it*. Grass that will keep ten oxen in growing order will fatten five oxen quickly. Stock of all kinds are constant feed-

ers, and there should always be forage enough to enable them to get plenty to eat without the labor of hunting for it.

There is much variety of opinion on the amount of stock that ought to be put on an acre. This arises from the difference in the capacity of the land, some soils being rich, dry and porous, will stand much heavier grazing than others. It is safer to err on the safe side, and it is better to put in too few than too many. If stock are fattened quickly, they are more remunerative than when fattened slowly. Then, when one lot is sold out, they can be replaced by others. Ordinarily, two acres of grass are requisite for one three-year-old ox, and what will fatten one ox will fatten ten head of sheep.

Blue-grass should be allowed to go to seed once or twice, or until the ground is well set or turfed over, and then never more. It is a grass that propagates itself by its creeping roots or rhizomes, and it is the disposition of all plants and animals to lose vitality in the process of reproduction.

Though perennial, its vitality may be greatly lowered by the effort of reproduction, so that it may lie dormant for some time afterward, before starting again its vigorous growth. Stock should be kept out at seeding time, or before, in fact, so as not to eat down the seed stalks.

It sometimes happens that dry weather sets in during the summer months, and the grass becomes so dry it will burn. Still stock will greedily eat it. The grass having dried full of nourishing juices, it is equal to the best of hay, and stock will still fatten upon it unless the dried grass has been drenched with rains.

The fall growth of some lots should be kept untouched by stock, and in this way a fine winter pasturage will be secured. The grass will get high enough to fall over and protect the surface foliage, and stock will keep up their flesh on it during the winter without feed. When snows fall, cattle will require to be fed, but horses, mules and sheep will paw off the snow, unless it is too deep, and get at the grass. It is the first deciduous plant that puts forth its leaves in the spring. Good fat lambs can be sent into the market earlier than from any other grass.

It makes milk rich in butter, and gives the latter a fine golden color, without changing its taste, or, like clover, imparting its peculiar flavor to it.

The following is an analysis of this grass, as compared with some other well known grasses. (Way).

FIRST—DRIED AT A TEMPERATURE OF 212°.

100 PARTS OF.	Flesh-forming Principles.	Fatty Matters.	Heat-producing Principles.	Woody Fibre.	Ash.
Blue-grass give -----	10.35	2.63	43.06	38.02	5.94
Timothy -----	11.36	3.55	53.35	26.46	5.28
Orchard-grass -----	13.53	3.14	44.32	33.70	5.31
Clover -----	22.55	3.67	44.47	19.75	9.56
White clover -----	18.76	4.38	40.04	26.53	10.29
Sweet-scented vernal -----	10.43	3.41	43.48	36.36	6.36

SECOND—AS TAKEN FROM THE FIELD IN BLOSSOM.

WITHOUT DRYING, 100 PARTS OF.	Water.	Flesh-forming Principles.	Fatty Matter.	Heat-producing Principles.	Woody Fibre.
Blue-grass give -----	67.14	3.41	0.86	14.15	12.49
Orchard-grass -----	70.00	4.06	0.94	13.30	10.11
Timothy -----	57.21	4.86	1.50	22.85	11.32
Red clover -----	81.01	4.27	0.96	8.45	3.76
White clover -----	79.71	3.80	0.89	8.14	5.38
Sweet-scented vernal -----	80.35	2.05	0.67	8.54	7.15

There is, in all pastures, a number of bare spots that seem to resist the efforts of blue-grass to sod. By mixing other seeds with the blue-grass, these spots can be made to produce as well as other places. In a natural meadow, by careful counting, several species are often found growing intimately on every inch of earth. On a good natural pasture in one square foot of sod, there have been counted 1,000 plants, consisting of twenty distinct species. This is Nature's own arrangement, and may

be safely copied. In such a pasture not an inch of surface is unoccupied. It may be thought an inch or two here and there makes but little difference in the space occupied. But every blade of grass is of some importance, and it is astonishing the aggregate of these barren places.

Now, once more, let it be urged on the farmers of Tennessee to look into the matter of pastures, and provide themselves with this highly important adjunct to every farm. No home is complete without pastures, and yet there are many who will depend either upon the fortuitous wild grasses for grazing, or feed their stock from the crib all through the year. With a rich blue-grass lot, no stock need be fed, except while at work; and, indeed, it is sometimes the case that in dry, scarce years, crops have been made with horses and mules that had no other provender than a blue-grass lot.



SHEEP'S FESCUE—*Festuca ovina*—
Perennial.

The fescue grasses are very popular in New England, and grow well in Tennessee, having been introduced in some localities. They are perennial, and grow in tufts, and from their profuse foliage they form excellent pasturage for cattle, and especially for sheep, hence the name of one variety. Mixed with other grasses the sheep's fescue would be a good addition to our native grasses. It would be especially useful on dry hill-sides, or sandy, old fields, where blue-grass will not thrive well. It has long leaves, and they are much sought for by cattle. It has been grown extensively in East Tennessee, and is grown in some localities in Davidson County, without much success. The Hon. Staunton Gould says this grass forms the great bulk of the sheep pastures of the Highlands of

Scotland, where it is the favorite food of the sheep, and where the shepherds believe it to be more nutritious for flocks than any other. Gmelin says the Tartars choose to encamp during the summer where this grass is most abundant, because they believe it to be the most wholesome for all cattle, but especially for sheep. Linnæus asserts that sheep have no relish for hills and heaths without it. It grows in dry, sandy soils, where all other vegetation parches up. The roots are long, turf short and dense, making it well suited for lawns.

It retains its verdure during the most extended droughts. It will not bear maturing, for then it is dispossessed by other grasses. Its great value is for pasturage upon sandy soils. It will suit the Cumberland Table-land. The Woburn experiments showed that, cut at the time of flowering, the product of one acre was 5,445 pounds, which gave 212 pounds of nutritive matter. The same number of pounds was obtained, cut when the seeds were ripe, but there were only 127 pounds of nutritive matter. The aftermath yielded 3,403 pounds of hay, having 66 pounds of nutritive matter. From this it appears that there is a difference between the results obtained by chemists and practical feeders as to its nutritive properties.



MEADOW FESCUE—RANDALL GRASS
—EVERGREEN GRASS—*Festuca pra-*
tensis.

This grass has received some attention in different parts of the State, and has met with a warm reception from those testing it. It ripens its seed long before any other grass, and, consequently, affords a very early nip to cattle. It has been raised under various names, in Virginia, as "Randall grass," in North Carolina as "evergreen grass." In the

mountain lands of Virginia, a writer says: "The variety of forage best adapted to sheep-grazing on the mountain lands is the 'Randall,' a tall, coarse grass, growing freely on the rocky soil to a height of six feet, remaining green and affording fine herbage all the winter."

The evergreen grass is very good for pasturing through the fall and winter. It will do best when sown on dry land, and is well adapted to sheep, cattle, horses and mules. It grows well on rocky soil, to the height of four or five feet when ripe, continuing green throughout the winter months, and affording fine herbage. It is best to sow about the 10th to 15th of September. A peck of well-cleaned seed is enough for an acre, or a bushel in the chaff. It ripens about the first of June, or a little before rye harvest, and is cut with scythe and cradle, reaper or mower.

TALL FESCUE-GRASS—*Festuca elatior*.

This is a variety of the same, naturalized from Europe, and suited to a rich loam, such as is found in the Central Basin. The Woburn experiments show it to yield more nutritious matter per acre, when cut in flower, than any other grass, cut either in flower or seed. The number of pounds obtained was 51,046, which weighed, when dry, 17,866 pounds, loss in drying, 33,180 pounds and furnished 3,988 pounds of nutritive extract.

There are several other fescue-grasses, as the Spiked Fescue, (*F. lolaacea*), Hard Fescue, (*F. duriuscula*), and the Nodding Fescue (*F. utans*), all indigenous to this country. The last two are good hay grasses, as well as the Meadow Fescue. The Hard Fescue was analyzed by Way and found to contain water, 69.33; flesh formers, 3.70; fat, 1.02; heat producers, 12.46; woody fibre, 11.83; ash, 1.66. The Woburn experiments gave as the produce of one acre, 18,376 pounds, cut in flower; loss in drying 10,116 pounds; nutritive matter, 1,004 pounds. Cut in seed, the produce weighed 19,075 pounds, loss in drying, 10,481 pounds, leaving nutritive extract, 446 pounds. It grows well on a sandy loam. The seeds weigh ten pounds to the bushel.

TALL MEADOW OAT GRASS—*Arrhenatherum avenaceum*.

This grass is very popular in France, from whence it was introduced, and is there known by the name of "Ray Grass."

It will grow well on any land that produces clover. Its limit is about 1,500 feet above the sea. It grows quickly, and forms a very excellent grass for early pasturage, probably earlier than any other. It is mown down for hay, and, after cutting, it throws up a perfect mat of aftermath that will yield an extremely rich pasture. It was only introduced into Tennessee a few years ago, and it has received extravagant praises, as is usual with new introductions.

It succeeds well in West Tennessee, and will probably suit that locality better than any other grass, except Herd's-grass. It would form a good grass to mix with others, such as timothy, Herd's-grass, clover or blue-grass.



The analysis of the hay by Way, is as follows: Flesh formers, 12.95; fatty matters, 3.19; heat-producing principles, 38.03; woody fibre, 34.24; mineral matters, 11.59.

This shows it to rank as a nutritious grass, among the best of the meadow grasses, and almost equal to any of the pasture grasses, though it is said cattle and sheep do not like to be confined to it alone. The produce from an acre from Mr. Sinclair's experiments at Woburn, was 17,015 pounds; loss in drying, 11,635 pounds; nutritive matter, 664 pounds. Cut when the seeds were ripe, the weight was 16,335 pounds; loss in drying, 10,617 pounds; nutritive matter, 255 pounds. Weight of aftermath, 13,-

612 pounds; nutritive matter of which was 265 pounds.

SWEET-SCENTED VERNAL GRASS.

Anthoxanthum odoratum.



This grass was introduced from Europe, and possesses rather poor qualities as a pasture grass, as neither sheep nor cattle relish it. It is early, however, and hardy. It is one of the first as well as one of the last grasses that appear. Its nutritive qualities are said to exist to a much larger extent in the fall than in the spring, and greater when cut at maturity than in bloom. It has a mixture of benzoic acid among its constituents, which imparts to it a highly aromatic character, and this is so strong that other grasses with which it may be mixed are affected by it. It is not in general use in Tennessee, but would most probably add to the value of pastures if sown with other grasses. Cows running on it are, by some, said to give a rich milk and highly flavored butter, but Mr. Gould thinks this is an error. It may be known by rubbing the green leaves in the fingers to which it yields its scent. On certain soils favorable to its growth, it will root out almost every other kind and take complete possession. Its seed have a spiral awn, and when taken in the hand, affected by its moisture, the awns will uncoil, and the seed will appear to move as insects.

There are six or seven pounds of seeds in a bushel, and nine hundred and twenty-three thousand two hundred in a pound. Its analysis, according to Way, ranks it, when dry, a little higher than blue-grass, as follows: Flesh formers, 10.43; fatty matters, 3.41; and heat-producing principles, 43.48. Blue-grass gives, flesh formers, 10.85, fat, 2.63; heat producers, 43.06.

The best test of all grasses is their effects upon animals. If animals thrive and fatten upon any grass, and that grass is per-

ennial, hardy and durable, it is a good pasture grass; otherwise not, whatever individual experiments in the laboratory may indicate. We know that stock of all kinds eat blue-grass voraciously and thrive upon it; we know also that they do not like the *anthoxanthum*. Both are alike hardy and durable. Therefore the blue-grass, upon suitable soils, is to be preferred, whatever chemical research may determine.

WHITE CLOVER—*Trifolium repens*.

White clover has been lauded to the skies by some, and by others depreciated as a vile weed. It is, beyond question, next to blue-grass, one of our most valuable grazing plants. Its analysis shows it to be equal to red clover in most respects, and superior as a fat-producing plant.

It is to the pasture what red clover is to the meadow, and is a suitable food not only for cattle and horses, but for hogs. They thrive amazingly on it. After the first flowering it salivates horses, but has no such effect upon cattle or sheep. As a honey-producing flower the white clover is not surpassed by any plant, the florets some years being almost full of syrup.



It varies very much in different years, sometimes almost disappearing, then again, another year, being thick in every pasture. So much is this the case, that we have what are called "white clover years." This is due to the presence or absence of rain. When there is a wet spring white clover appears in great luxuriance everywhere, and in dry weather it only shows itself in abundance on moist lands.

It is indigenous to both Europe and the United States, and though growing everywhere here, it has to be sown on the Northern pastures. Here it comes spontaneously, almost tak-

ing every other grass, and sometime destroying other grasses. It is an invaluable accompaniment of blue-grass, especially triumphant where the blue-grass is pastured too heavily.

The comparative value of white and red clover, cut in bloom, may be seen by the following analyses by Prof. Way :

CLOVERS.	Water.	Flesh formers.	Fat.	Heaters.	Woody fibre.	Ash.
Red clover-----	81.01	4.27	.69	8.45	3.76	1 82
White clover-----	79.71	3.80	.89	8.14	6.38	2 08

JAPAN CLOVER, OR KING GRASS—*Lespedeza striata*.

It has been but a few years since this plant has been brought to notice in this country, though its existence was mentioned as early as 1784 by Thunberg, a German chemist, who saw it growing in Japan. About the year 1849 it was noticed in the vicinity of Charleston, S. C., the seeds having been brought probably from Japan or China in tea boxes. A short while afterwards it was discovered at a distance of forty miles from Charleston, and still later near Macon, Ga.

Within the last six years it has developed itself in many of the counties of this State, especially in Henderson and Warren, where it is covering all old fields, and in many instances rooting out broom-grass and other grasses, showing itself well worthy of the name given it by Mr. Pendleton, of king grass.

It seems especially adapted to the Southern States, not flourishing above 36°, growing with great luxuriance on the poorest soils, and retaining vitality in its roots in the severest droughts. It is said to be a fine plant for grazing, and being perennial in warm climates, needs no resowing and but little attention. On soils unfit for anything else it furnishes good pasture and supplies a heavy green crop for turning under and improving the

land. It cannot stand severe cold, and in high latitudes cannot be depended on as a good pasture grass, although it comes up and supplies an abundant forage for a few months. It should be sown in January or February in the Southern States, and about one bushel of seed to ten acres is required to secure a good stand the first year. It is said to be an excellent renovator of old fields, and to bring them up to a high degree of fertility in an incredibly short space of time.

Mr. E. M. Pendleton, of Georgia, speaking of it, says: "I am willing to concede to it several things that do not apply to any other plant we have ever grown in this latitude:

1. "It grows on poor land with more luxuriance than any other grass or weed I have ever seen; and as it has a small leaf, rather contravenes the general idea of vegetable physiologists, that large-leaved plants feed mostly on the atmosphere. I suppose, however, that this deficiency is counteracted to a large extent by the number of leaves, for they are legion.

2. "It has great powers of endurance, so far as the roots are concerned; but the branches and leaves will parch and die out under a burning sun very soon, especially where it grows sparsely. During a wet summer it luxuriates wherever propagated on poor hill-sides as well as meadow lands. It loves, however, rainy seasons, on thirsty lands, and I fear will not prove to be all we desire in such localities. It, however, reminds us of an anecdote of Mr. Dickson, when he was showing some gentlemen his farm during the prevalence of a severe drought. As they passed through a corn-field in which some of the stalks were actually dying for lack of moisture, one of them called his attention to several in that condition. "Yes," said he, "I perceive the fact—but *it dies game*." And so of the Japan clover—it dies from severe drought, but rallies again as soon as the rain sets in.

3. "It is a good pasturage for stock, and I think would make good hay, if cut and cured. This I intend to test the present season. But I do not believe that our stock like it as well as the native grasses, and doubt whether it is as nutritious as the Bermuda. As cattle love variety, however, this may subserve

a good purpose in that way. My opinion, however, is, from not very close observation in the matter, that they would soon tire out on it exclusively.

4. "It furnishes a large supply of vegetable matter to the soil, and I believe will prove to be the best humus-making plant we have at the South, where so much is needed from our clean cotton culture. As it is said to be difficult to gather the seed in large quantities, I intend to plow up the surface where it has seeded, and rake up the grass and top soil, and sow this dirt over my oat and wheat fields, and especially on the poor places. My opinion is that a most luxuriant growth of this clover will follow, which can be turned under in the fall while green, and thus furnish not only humus but nitrogen to the soil.

5. "Another rare quality of this plant is indicated in the name I have given it—king grass—in the fact that it absolutely roots out and destroys every living plant in its widespread path. Not even old Bermuda, which has so long held undisputed sway over his circumscribed fields, can resist its encroachments. I have a bottom long since given up to the Bermuda. Recently I passed through it and found that the *Lespedeza* had almost completely throttled it, though like Mr. Dickson's corn, *it died game*, as here and there, peering above its enemy, could be seen an isolated sprig of Bermuda, which, as it cannot stand shade, will have to yield entirely before the close of another season. I have but little doubt that any pest like coco or Bermuda could be rooted out by this *king grass* in a few years in any locality, and would recommend it to be sown on such fields if for no other purpose. I intend to give it a fair trial myself on one or two similar localities."

In like manner the Hon. H. W. Ravenel, of South Carolina, regards it with great favor, and thinks its timely appearance will be ultimately a source of great wealth to the people of the Southern States. Many places that were regarded as worthless before its appearance, are now made profitable as a pasture, with the aid of this grass.

Mr. Samuel M. Ramsey, of Warren County, says this clover made its appearance in that locality in 1870. It is fast covering the whole country. It supplies much grazing from the first of August until frost. It is short, but very hardy. Sheep are very fond of it, and cattle will eat it. It is killing out the broomsedge wherever it appears. It grows exceedingly well on red clay, and with a little care covers red hillsides that are much too common all over the State. If it will do this and destroy the broom-grass, it should be cultivated. It is not good for meadow and is only valuable for pasture.

REPORT OF PROCEEDINGS
OF THE
EAST TENNESSEE
FARMERS' CONVENTION
HELD AT
KNOXVILLE, MAY, 1885.

REPORT.

Despite the untoward drift of business for many months, the farmers seem filled with the hope eternal, and manifest an increasing interest in their Annual Convention. The attendance at the opening exercises was certainly encouraging. The character of the assemblage was undoubtedly one of which East Tennessee agriculture may feel proud.

The session opened promptly on time at the rap of President John M. Meek's gavel.

Having come to order, in behalf of the convention, prayer was offered by Rev. T. S. Scott.

Mr. J. W. Wallace then announced that Judge H. H. Ingersoll had been chosen by the citizens of Knoxville to deliver, on their behalf, an address of welcome to the farmers.

Judge Ingersoll then arose and made the following appropriate remarks :

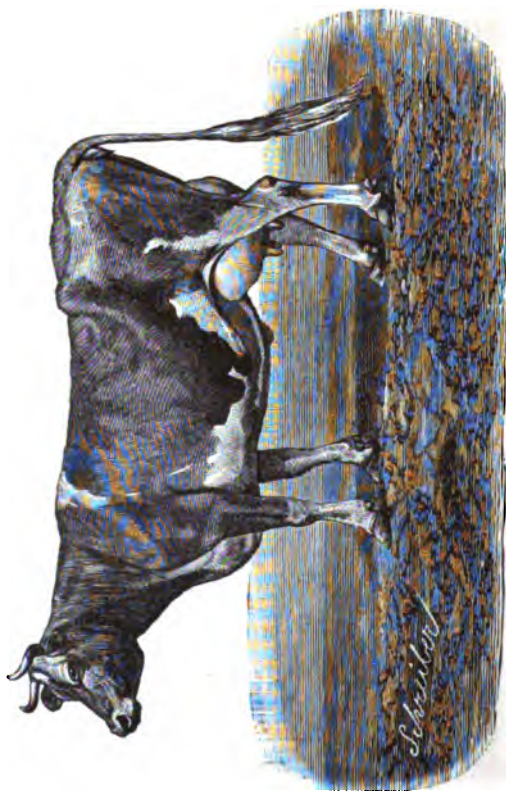
GENTLEMEN FARMERS OF EAST TENNESSEE: I feel complimented by the choice of my fellow citizens for the performance of this duty; and in their name I bid you welcome, one and all, to our city; the young among you who come for the first time to see its attractions, and the old who have seen this place grow from a stage-coach town of 2,500 inhabitants to a railroad center of 25,000 people. Welcome to your city! For while we may own the lots and the brick and mortar, the city is built of your patronage and trade. It is your business and commercial center. It thrives from your prosperity, and sorrows in your misfortunes. And but for the energy, intelligence and thrift of the farmers of East Tennessee, Knoxville would to-day be only a wayside village on this great thoroughfare. You have a direct interest in our University, our schools, our stores and our man-

ufactories, and all our institutions, and that interest is thoroughly reciprocated by the people of this city. On behalf of her merchants and manufacturers, her tradesmen and professional men, therefore, I welcome you to our stores, our factories, our offices and our homes. It is a goodly city, and stands in the midst of a goodly land. We are proud of it, and we rejoice in the interest you take in our progress and welfare.

And in turn, fellow-citizens, we desire your improvement and prosperity; we wish your wealth to increase, your barns to grow larger and better, your fields more productive, your stock more valuable, and your homes more attractive and beautiful. Good barns make good stock; good homes, good men. Stock need protection as much as men, and no man can be a good farmer who fails to make proper provision for his stock.

You need better roads, too, and for this you must have co-operation. Do as we are doing in Knox and as they are doing in Hamilton County. Utilize your convict labor, and double the value of your farms. You all wish to prosper; if so, you cannot afford to sell your corn and oats and hay. You must grow grass and sell hay, and cattle, and mules, and hogs. The grass farmer never fails. He lives easily and his herds increase. He buys out a grain-growing neighbor, who tries his fortune in a new country.

With good barns, good stock, good roads, grass farms and good houses, we have the pattern of a good farming country. Make life easy for the wife, and keep the bloom in her cheek and the wrinkles from her forehead. Make the homes happy and keep the children in them. Provide books and journals for them and for yourselves. Study the economic questions that interest you. You are in a forced partnership with the manufacturers, merchants and shippers of the country. Understand the relation, so that you may make good terms and get your share of the profits. Unite in your own interests. Study your own welfare. Take counsel with each other. Profit by your neighbors' failures as well as your own. Imitate his successful methods, and thus reach the ideal state of the farmer—the first, the most universal and most enduring occupation of mankind.



LANDSEER'S FANCY (2876.)

Test, 29 lbs. $\frac{1}{2}$ oz. in seven days. 936 lbs. 14 $\frac{1}{2}$ ozs. in a year.

Property of WEBSTER, MORROW & SON, Nashville, Tenn.

The President called upon Col. J. B. Stokley to respond on behalf of the farmers. He did so in graceful language.

President John M. Meek then delivered the annual address, which is as follows :

GENTLEMEN OF THE EAST TENNESSEE FARMERS' CONVENTION :

Custom and also precedent, exacts an annual address by your President. In complying with this duty, I first offer you my hearty congratulations upon this, the Tenth Annual Meeting of the East Tennessee Farmers' Convention.

Its organizers certainly builded wiser than they knew, and they deserve and should receive all the honor thus earned. From its organization has sprung a body composed of sturdy farmers of sterling worth, and a wide-spread and deep interest has taken hold of the minds of all classes of our people in its proceedings.

Ample encouragement to farmers is found in the success that has attended the meetings heretofore held. Old prejudices have been swept away, and farmers have been brought into closer and better relations with those of other callings and professions, and thus a united effort has been made by men of all classes to build up, foster and develop the latent industries and resources of East Tennessee. Nearly all kinds of grasses have been introduced to cultivation, and our worn-out and sterile fields are being reclaimed and clothed with living verdure, and populated with herds of horses, cattle and sheep. Improved and labor-saving machinery is solving the knotty problem of farm labor. Improved breeds of horses, cattle, sheep and hogs have been introduced, each having its special advocates; while many business men, having accumulated large fortunes in mercantile and railway enterprises, wearied and worn with the merciless turmoil and unsystematic intercourse of commercial life, turn to the peaceful and restful culture of the farm with their surplus wealth for recreation and home enjoyment and the introduction and rearing of thoroughbred stock.

Prominent among those thus engaged in progressive farming with unstinted means—we may be pardoned for personal men-

tion—is Hon. Perez Dickinson, of Knoxville, whose Island Home farm has been given a national fame by the princely and munificent expenditures of its owner in its artistic and practical culture of all the grains, grasses, fruits and flowers, and the rearing of the best of breeds of horses, cattle and hogs. Not less among the kindly acts of the proprietor of the Island Home has been his unostentatious kindness in exhibiting the fruits of his labors to every one wishing to see them. Thus he has disseminated useful information and generated a spirit of emulation and progress among the farmers of East Tennessee.

We may also mention Hon. C. M. McGhee, with his handsome farm at McMillan's, in Knox County, stocked with Percheron horses and Holstein cattle. Col. McGhee being the pioneer in the introduction of the Holstein breed of cattle, and also owner of the imported Percheron stallion, Perfect. We may further mention the Strong Brothers, J. C. and G. H., whose splendid farm adjoins that of Col. McGhee, and who have already proven the profit and progress of grass and cattle farming and join in the introduction on their farm of the beautiful Holstein cow. Nor can we pass without mention—W. S. Shields, of Grainger, Hon. Sam Rodgers and W. M. Cannon, of Loudon; W. Gettys, of McMinn; O. P. Temple and J. L. Thomas, of Knox—as introducing and breeding the handsome little Jerseys. Nor must we pass in mention—John M. Jones and Hon. James Love, of Monroe, and A. X. Shields, of Grainger—in pushing into favorable notice the lordly Shorthorn as a useful and profitable animal on the farm, and Hon. James M. Meek as introducing the useful Ayrshire.

It is with pride that we refer to these instances of the result, either directly or indirectly, of the work of the East Tennessee Farmers' Convention.

We may also refer to the increased production of wheat as a result of the discussions held in this annual convocation of farmers. The yield per acre has been in many instances quadrupled, reaching as high as fifty-six bushels per acre, and old lands have been resuscitated and made redolent with clover blossoms and new-mown hay. May we not congratulate ourselves on the

beneficial results thus attained, and look forward to a greater and grander work in the future? There remains much to be accomplished yet in the interest of agriculture.

There are many and grand problems connected with the advancing civilization of the age. Greedy monopoly stands on the alert ready to seize any advantage presented through defective legislation by unsuspecting, unwise or dishonest legislators.

The wrecks of monetary institutions and loss of private fortunes, and embezzlements of public funds that line the business avenues of the past year, indicate the mad and criminal pursuit of speculative gains, rather than those of honest, though slower and safer venture.

The old question of supply and demand, which in old-fashioned political economy was supposed to regulate the price of all commodities, has, to an alarming extent, been set at naught by the newer and modern process of pooling freights and consolidating competing lines of transportation, stock gambling and dealing in futures of all farm products. Without a minute discussion of either, any or all these processes, it is sufficient to say that they are subversive of all the underlying principles of honesty and stability in the commercial interchange of commodities of all kinds taking place in the marts of trade and commerce. Fictitious values are created and maintained only for a specific purpose for a limited time. In other words, for the purpose of perpetrating frauds upon the unwary and unsuspecting. Those who are experts in this kind of business are politely denominated Bulls and Bears. This is the prolific source of untold disaster upon the material and industrial interests of the country. Hence spring, theft of public and private funds, betrayal of public trusts, embezzlements, infamous frauds and swindles. Individual rights are ignored and trampled under foot, and this gives birth to the spirit of communism, nihilism, socialism, dynamiters, assassination and suicide. Indeed, we cannot contemplate the evils following in the wake of the modern processes of dealing in futures and stock gambling for fraudulent purposes, under the guise of legitimate trade without standing aghast.

This continued disregard and violation of the rights of one class by another class will in the end result in anarchy and revolution, just as certainly as that any other violation of natural law will produce abnormal results, unless the power of right and justice is invoked, through the enactment and execution of such laws as will prohibit and punish such methods. Otherwise the fabric of free government becomes unstable, patriotism loses its votaries and the liberties of the people are engulfed amid the red billows of war. There are problems of political economy yet unsolved if the present condition of the laborer and the price of breadstuffs in the United States is the natural standard. Political economists will have to lay new promises and take new bearings in order to meet the new condition of things. Cheap bread should certainly be a blessing to the laboring man. But with breadstuffs at present unprecedented low prices, there seems never to have been so many workingmen out of employment. And there is no virtue in cheap bread to a man out of both money and work.

The grain markets of the world are glutted and meat products are in abundance. The demand for manufactured goods seems more than supplied, and yet we are told that the avenues of trade and commerce are almost barren of paying results. The facts seem patent that the grain-producing and manufacturing world have produced more than the world can utilize in one year. Especially is this so in our own country, as to the production of wheat and corn. And we, of East Tennessee, are driven to the wall in the production of these cereals by the great, illimitable West and Northwest.

What lessons of profit are we to learn from this state of things, and where is our remedy, when corn and wheat grown in the West can be laid down in Knoxville, Richmond and Petersburg for less money per bushel than it costs us to produce it, and for less expense in freight from Kansas City and Chicago than we can place our own grain in the same markets, with the advantage of distance in our favor?

Our remedy is not in carping with accomplished facts, but in changing our system of farming so as to meet the new requirements as they occur. Our remedy is in availing ourselves of

the advantages given us by nature. The principal one of these is, that by nature and all favoring conditions this is a grass and hay country, and if a grass and hay, then a cattle, beef, butter and sheep country; as well, also, of horses and mules. But, specially, it is a cattle and dairy country.

And this is the "open sesame" that is to restore our farms and retain their fertility and give prosperity and happiness a permanent home in our midst. Already the dawns of the new era are beginning to give light. To this particular line of husbandry your attention is earnestly invited, that all information relevant thereto may be extended. The study of the prices of all kinds and breeds of cattle, together with the price of dairy products in the markets of the world, cannot fail to throw some useful light upon the subject and give encouragement to those seeking information. It will be seen that while all kinds of grain and manufactured goods are depressed in price, yet the price of cattle and all dairy products have steadily advanced, with still an upward tendency, at more than remunerative figures.

The enormous destruction of cattle on the great ranches of the West, by freezing and starvation, precludes a possibility of a glut in the beef markets, and gives assurance to smaller feeders of a permanent market for carefully raised steers.

A recent writer, who has traveled over the entire region of cattle ranges in the United States, gives it as his opinion that Southwestern Virginia, Western North Carolina, Eastern Tennessee and North Georgia have more of the conditions necessary for successful cattle-growing and dairy farming than all other places combined.

This is pretty strong evidence, and is given for its worth. Many facts might be given to corroborate and establish its truth. We have a permanent market for all the surplus beef, butter and cattle, and hay that we may produce. The entire South Atlantic and Gulf States to-day are without an adequate supply of good butter, beef and hay, and with our increasing facilities for transportation we may get into those markets with these products, on an equality with other sections. This may be sup-

plemented with the production of early vegetables and fruits for Northern markets, but recently brought within our reach by the newly built lines from Knoxville and Chattanooga. Here, then, is a wide field for intelligent enterprise opened to our people. Registered and pedigreed calves, Shorthorn, Devon, Holstein and Jersey, readily sell at \$50 to \$100 apiece at six months old, while those grown, with assured and developed good qualities, sell for still larger sums. These prices have been maintained for years in the markets of the world, almost without fluctuation.

Here we have all the conditions of climate, soil and water to make it the home of the Shorthorn, the Holstein, the Devon and the Jersey, if we will but avail ourselves of these conditions by intelligent effort. This must, in the near future, prove the leading industry of East Tennessee.

We raised more of corn and wheat and hogs the past year than could be sold with a fair margin for profit. Not so with cattle or first-class butter. Perhaps four times as many grades of Shorthorn steers could have been sold at a good profit if our people could have furnished them.

There is a steady demand for a No. 1 butter the year round, for twenty-five cents and upward per pound.

Let us occupy these fields for many reasons, but principally two. First, because of the profit and less labor involved, added to its maintaining at less cost the fertility of our lands. And second, because this is progressive farming when we can avail ourselves in the highest degree of natural advantages, and make them yield profitable results, and superadded to both of these reasons, is the establishment of comfortable homes, owned by a contented and happy people, who love their country and the place of their birth. This sentiment, cultivated and firmly rooted in the minds and hearts of our people, will beget a pride of country and love of home and the land of birth and spirit of contentment that will effectually estop the migratory spirit of unrest that has already found a lodging in too many of the homes of our people. Surely we have a country worthy of our love and veneration. Let the spirit of Scott's lines, in his "Lay of the Last Minstrel," permeate our homes and our hearts:

Breathes there a man with soul so dead,
 Who never to himself hath said—
 This is my own, my native land;
 Whose heart hath ne'er within him burned
 As home his footsteps he hath turned
 From wandering on a foreign strand.
 If such there breathe go mark him well,
 For him no minstrel rapture swell,
 High though his titles, proud his name,
 Boundless his wealth as wish can claim;
 Despite those titles, power and pelf
 The wretch concentrated all in self;
 Living shall forfeit fair renown
 And doubly dying shall go down
 To the vile dust from whence he sprung
 Unwept, unhonored, and unsung.

Be it then our work to foster and strengthen this pride of country and love of home among our own people. A country that can give to the world such men as Hugh L. White, Thomas A. R. Nelson, Landon C. Haynes, Andrew Johnson, Isaac Anderson, John Sevier, J. G. M. Ramsey, and many others equally distinguished in the civil, political and industrial interests of the country, is one of which to be proud.

The voices of Nelson and Haynes, though hushed in the silence that knows no waking to mortal life, still pulsates amid the peaceful valleys and echoing cliffs surrounding the homes of our people.

The venerable historian, Ramsey, has left a monument no less honorable to his native East Tennessee than to himself in his "Annals of Tennessee." The lives of many noble sons are interwoven in the traditions and history of our people. Invoking the spirit that animated these sons of East Tennessee, let us renewedly dedicate our best efforts to the development of the resources—mineral, agricultural and educational—of our beautiful East Tennessee. Let us labor to establish a better and more progressive system of tillage, and in promoting in the minds of the people a higher regard for honest labor. Thus we may more surely subserve the ends of patriotism, philanthropy and good citizenship.

Our waste places may be reclaimed, and the horn of plenty may be made to pour its treasures into our laps. But the field for effort is wide and the work vast. Ignorance and blind prejudice are to be met and conquered. These are not found alone in isolated farm houses and the sequestered cabins and coves of the mountains, but are met in the midst of open highways and crowded streets; especially does blind prejudice hold its sway in unseemly places and block the advance of new ways and ideas. But encouragement is found in the fact that some advance is made. The movement is forward, not backward, though it be slow. The prejudices of three centuries' growth are not to be plucked up in a single generation, but, like the firm adamant, are to be cut away, a little at a time, with the sharp point of truth, under the hammer of perseverance and industry. These are the talismanic virtues and qualities that have thus far engineered and cast up the highways of progress in all the departments of human aspiration, industry and attainment. Invoking thus this spirit of enlightened and co-operative effort, to the successful accomplishment of the ends suggested, and a firm reliance upon God's providence, our success is assured.

With the earnest desire that a spirit of harmony may characterize all our proceedings, and asking your kind indulgence, I declare the Convention open for business as it appears on the programme.

By motion of Col. C. W. Charlton, Mr. J. K. P. Wallace was made Assistant Secretary in the absence of Assistant Secretary Cate.

The President then announced that the body would proceed with the regular programme. In the absence of Mr. H. C. Whittaker, of Jefferson, to whom had been assigned the topic, "Business Farming," the President substituted Col. Charlton to fill his place, and the latter gentleman made the following remarks :

MR. PRESIDENT AND GENTLEMEN OF THE CONVENTION : Business farming! That means a great deal more than I feel myself able to unfold. You told me, Mr. President, that you had ap-

pointed another gentleman to read a paper on this subject, and that he had declined. You then asked me to take his place. I consented, not because I considered myself competent for the task, but simply to allow no interest of this convention to go by the board, if possible. The term business, as defined by lexicographers, means employment; that which occupies the time, attention and labor of men.

So when we speak of business farming we are supposed to mean employment; that the farmer has his attention directed to the work of his farm, giving it his time and attention. Farming is his business, and it therefore demands not only his attention, but his constant care and oversight. He cannot carry it on successfully by proxy. He must be a part and parcel of it himself, see to everything and manage everything. Reason would teach him, and self interest would urge him to know all about his business. He must comprehend it in its details. He must know the exact condition of his farm, the number and condition of his stock. He must know when to sow and when to reap; how to sow and how to gather in the largest returns. These matters he cannot well afford to leave in the hands of a proxy, any more than a merchant or a manufacturer can afford to leave his business in the hands of clerks.

It is not reasonable to presume that a proxy or middle man would take as much interest in the management of the affairs of a farm as the landlord. There are many interests he would probably overlook or neglect. The surest road to success in any business is the watchful eye of the principal. He will keep everything in its place, and have a place for everything. He will see that no plows and harness and hoes are left in the fields. He will see that his stock is cared for, that they are fed and watered regularly.

Nor can business farming be consistent with the tenant system, or renting or leasing farms. They are directly at variance. There are few, if any, tenants who will be as careful and enterprising in the management of a farm as the owner. The most of the lands now rented in East Tennessee are in bad condition, and are going from bad to worse. The invariable rule of the tenant is to make all he can without any regard to

maintaining and perpetuating the fertility of the soil. He will tax its capacity to the fullest extent, and rarely ever be generous enough to return to it an equivalent in the way of clover and manure. He neglects the fencing. If a rail falls off, or is knocked off, he lets it lay. If a hinge on the gate or on the stable door breaks, he says it is the duty of the landlord to replace it. If the manure accumulates in the stable he will let it remain there to rot the building rather than haul it out upon some poor field where it would be worth something to him or the owner. If there are poor or galled spots on the farm he will shun them as he would a plague. He will allow the briers to grow in the fence corners and in the field.

This doesn't tally with our ideas of business farming. The landlord, by the time he pays his taxes and counts the interest on his investment, will find himself coming out of the little end of the horn. There are men here, to-day, who will bear me out in this assertion.

Farmers are not business men in the sense that merchants and manufacturers are business men. If they were, they would know more about their business. How many farmers in East Tennessee keep a set of books? And yet, this is absolutely essential to success. At the end of the year they cannot tell just how they stand, whether they have lost or made money. They buy and they sell, and make no entry of it. They have not even entered on their books the amount of their investment in lands, houses, stock, etc., nor estimated the interest on it. They make no entry of their daily expenditures, or of their daily income. Could a merchant survive under a state of things like this? They would go into bankruptcy in ninety days.

If farming is a business it should be conducted on business principles, and if it is, it will pay. Badly conducted as it is, it is safe, or as safe as any other business. It is a remarkable fact, but no more remarkable than true, that fewer assignments take place among farmers than among any other class. In the midst of business depression, when times are hard and when other business interests seriously suffer, the farming interest remains firm

and unshaken. What a grand success it would be if we could bring to bear upon it strict business principles!

But business farming is not only applicable to thorough management, thorough knowledge of its details and a careful adjustment of expenditure and income, but it goes into other features of farming. It must adopt and push forward certain methods and appliances looking to the restoration of our exhausted lands. What does farming amount to if this end is not attained? Can we estimate the damage already inflicted upon East Tennessee by allowing our lands to go to destruction! Had they been taken care of and properly treated, millions of dollars would have been saved to the farmers of East Tennessee.

What is being done at present toward reclaiming them by the use of manure and grass? Where is your grass? Fully seventy-five per cent. of the farms of East Tennessee are without grass, and yet we have a grass country, the croakers to the contrary notwithstanding. There is no better region on the continent for orchard-grass than this. It is the home of red clover. Blue-grass does well if it has a fair chance. Do you think it is business farming to neglect the cultivation of the grasses? East Tennessee will never become a great agricultural region till it is covered over with grass.

Demosthenes was once asked what constituted an orator. He replied: "Action! Action!! Action!!!" If I were asked what constituted a good farmer, I would answer: "Grass, grass, grass!" It should be the absorbing question of the day, It will reclaim your lands and enhance their value.

Prof. Glenn, of the University, then asked the President to appoint a committee to visit the College Farm.

Col. Perez Dickenson asked that the Convention adjourn a few minutes at some time to-day, to look at his mammoth fat cattle, which would be driven to town for that purpose early this morning. A motion carried to adjourn fifteen minutes for that purpose at 9 o'clock during the morning's session.

The Convention adjourned to the regular afternoon session.

AFTERNOON SESSION.

The Convention was called to order at 1:30 p. m., by the President.

The following delegates were present as representatives from the various counties of East Tennessee :

Sullivan County—H. D. Hawk, G. R. Barnes, J. I. Cox, J. N. Rhea, H. K. Yost, J. F. Massengill, G. D. Massengill.

Rhea County—B. M. Ensign.

Union County—A. J. Brock, T. M. Widener.

Meigs County—W. B. Brown, R. E. Cate, J. P. Isom.

Hamblen County—Dr. Hale, Geo. Folsom, O. C. King, Judge Rose, Baldwin Harle, A. W. Lotspeich, Charles Taylor, W. H. Coffman.

Washington County—A. S. N. Dobson, President; J. A. Keebler, W. C. Keezle, T. B. Klepper, B. N. Mathes, Jas. C. Copp, Queni Stout, L. C. Peoples, S. H. Pouder, Wm. Powell, Enos. Kinchelo, Walter Brownlow, Judge S. J. Kirkpatrick, Mr. Montcastle, W. M. Mitchell, Dr. Armstrong, John Collins, Azor Miller, John M. Bayless, Wm. Taylor.

Greene County—R. M. Alexander, Dan'l Remine, Samuel Park, J. M. Dobson, W. B. Reeser, Henry Remine, D. D. Alexander, W. A. Leming, Capt. R. C. Carter, Wm. Armitage, John Armitage, H. D. Maloney, George Fink, Samuel Pickering, J. W. Hannah, R. B. Alexander, G. M. Gillespie, Samuel Dobson, J. W. McCoy, W. T. Kennedy, John Hardin, Wm. Lintz, J. Q. A. Remine, Byrd M. Robinson.

Blount County—James Rawlston, Richard Binnerly David Miller, W. B. Howard, J. C. Howard, J. N. Henry, J. C. Hale, Green Montgomery, Bart. Montgomery, S. O. Montgomery, J. E. Klepper, J. V. Griffiths, John Kizer, J. H. Howard, Richard Chandler, T. D. Carpenter, Sam. McCamameron, Jesse Brown, J. A. Goddard, Dick Goddard, John Smith, W. C. Anderson, Jeff Kidd, M. F. Garley, S. F. Bell, Wm. Wright.

Knox County—C. W. Charlton, P. Dickinson, John Crawford, John H. Moore, E. Legg, Robert Armstrong, H. Clapp, S. J. Tarvey, John Gibbs, John Campbell, John Luttrell, C. Mynatt, Robt. Wallace, J. W. Fox, R. W. Harden, J. M. Yarnell, W. Smith, Jas. King, W. Russell, G. W. Mabry, J. V. Fulkerson, W. S. Smith, N. Webb, W. A. Henderson, M. Carpenter, R. Badgett, M. Walker, A. J. French, John Madden, P. Carter, Gid. Strong, J. A. Harrison, R. M. Poston, J. M. Regan, R. Hartley, W. McCammon, W. Underdown, Shed Armstrong, J. A. Huffaker, W. C. Pickle, J. M. Pickle, Dr. Gillespie, G. M. McNutt, Jas. McCammon, John McCammon.

McMinn County—H. L. Cate, Oregon Dixon, M. A. Cunningham, A. K. John, D. S. Dorsy, H. L. Grubb, James Boyd, Davis McBroom, John Richards, A. C. Robeson, Col. W. T. Burkett, James Gettys, W. Gettys, J. G. Cate, Robert Dobson, H. H. Matlock, J. D. Lowry, Willy Browder, Van Smith, J. D. Cate, Dr. S. M. Carter, F. Brigham, W. H. Ballew.

Cocke County—Isaac Allen, John Allen, James Denton, John Holland, Douglass Neas, J. H. Larue, J. T. Huff, J. C. Marray, W. F. Morris, W. A. Robinson, J. H. Susong, B. B. Rorex, J. A. Rorex, A. Clevinger, J. B. Stokely, W. H. Sheffey.

Carter County—J. J. McCorkle, G. D. Taylor.

Monroe County—J. H. Pickel, John M. Jones, James W. Alley, W. B. Lenoir, H. B. Yearwood, Hugh Yearwood, John M. Montgomery, W. H. Smith, L. D. Smith, John Carter, J. C. Montgomery, Dr. S. B. Cook, John Miles, Dr. F. Bogart, J. M. Heiskell, Y. Roberts and son, W. D. Browder, J. H. Patten, W. H. Smith, H. M. McCrosky, J. C. Montgomery.

Anderson County—J. A. Brown, N. A. Offutt, Calvin Johnson, W. A. Kirkpatrick, F. F. Dawn, Orville Taylor, S. L. Moore, J. K. P. Wallace, W. H. McAdoo, H. S. Johnson.

Sevier County—J. W. Rodgers, J. C. Murphy, P. P. Seaton, Nelson Fox, John Kelly, J. M. Rumbo, J. G. Cannon, J. A. Henderson, Andrew Rodgers, S. W. Pickens, Tim. Chandler, B. W. Chandler, Wm. Catlett, J. P. Catlett, D. W. Payne, John Brabson, John Hodsdon, Rufus Kelly, W. P. Mitchell, W. P. Kern, John Chandler, Al. Gibbins, J. W. Andes.

The subject for discussion at this hour was "How to Make the Farm Pay," but, on motion, it was agreed to continue the discussion of "Business Farming."

Col. G. W. Mabry, of Knox, made a sensible talk on this subject.

Mr. W. H. Coffman, of Hamblen, read a carefully prepared paper on the subject of "Commercial Fertilizers," in answer to the attack made upon these fertilizers.

President Meek called W. H. Sheffy, of Cocke, to the chair, and he took the floor and joined in the discussion. He said there was no fertilizer in the world equal to barn-yard manure. He took up Prof. J. W. Glenn's report of the experimental work at the State Experiment Station and in the Agricultural Department of the University of Tennessee for the past two years, and read the result of some of the most important experiments made on the college farm. He advised all the farmers to read this pamphlet before buying commercial fertilizers of any kind.

Capt. C. E. Dunn, of Jefferson, made a brief talk in favor of commercial fertilizers.

Dr. Gillespie, of Knox, made a speech indorsing Captain Dunn's remarks. He thought it would be necessary to use commercial fertilizers for many years yet on poor East Tennessee farms before they were capable of producing sufficient barn-yard manure to fertilize the lands.

Col. C. W. Charlton, of Knox, closed the discussion, and made an able defense of his position in defense of barn-yard manure as the fertilizer for East Tennessee.

"How to Make the Farm Pay" was an able paper, read by ex-President J. B. Stokely, of Cocke County. It was brief and to the point, and one of the best talks ever made before the Convention.

Mr. Cate, of Meigs County, gave his experience in farming. He had been farming since 1856, and had made all that he is now worth by hard work. He did not have \$500 to commence

on, and his farm is now worth \$15,000 or \$20,000. He said to make it pay the farmer must work hard and take care of his land, and not be discouraged at failures.

Captain Dunn, of Jefferson, said he farmed six years and "busted." His misfortune was valuable capital to him. Since then he had made a good living at farming and a little more.

Judge Conner, of Knox, thought that almost any man who would work could make a good living and accumulate a little and add something to the value of his farm every year.

Mr. Widener, of Union County, said that he began farming two years ago fifty dollars in debt, and now owned a farm worth \$3,000. He made it all farming. His motto was to "keep things a turning" and keep turning in the right direction. Keep no dead capital invested. Sell what you have raised and reinvest the money.

Dr. A. S. N. Dobson, of Washington, thought that farming does pay. He thought that any man with a good knowledge of the business and with systematic work could make it pay. Do you work thoroughly? Instead of "going West" go deeper into the ground. Plow fewer acres and grass more. Use commercial fertilizers only as a last resort. The barn-yard manure pen is the farmer's bank. Cultivate only so much land as you can work well.

Col. Murphy, from Sevier County, asked: "If farming does not pay, how is it you all look so prosperous and comfortable?" He said farmers should not try to do too much. He began with a very poor farm and now had a fertile place. He believed in "turning." If you haven't clover to turn, turn ragweeds under. I have tried almost every kind of business, but farming pays better than any.

D. K. Remine, of Greene, said that farmers should not be discouraged because they could not always have money in the bank. He said that if a man began with a farm worth \$1,000, and at the end of five years it is worth \$6,000 on account of the improvements, that farmer has made money even though he has not seen a dollar.

Rev. F. Richardson, of Campbell County, said that there was no such thing as universal success in any calling. He thought, however, that a larger per cent. of farmers were more successful than the followers of any other business.

Hon. J. B. Stokely closed the discussion by defending his position that it was better to abandon a very poor farm and "go West" than to throw away labor on unproductive fields.

The next lecture on the programme was "Economic Entomology," which was a well prepared and a very interesting paper read by Prof. E. W. Doran, of Loudon County. The address dwelt at length upon the ravages made by the different species of insects upon the crops and advocated a stringent law forbidding the destruction of birds which devour insects.

The President appointed the following committee to visit the University Farm: B. M. Ewing, of Rhea County; J. A. Goddard, of Blount; E. Goddard, of Blount; J. W. Andes, of Sevier; H. C. Whittaker, of Jefferson; J. C. Murray, of Cocke; Dr. A. S. N. Dobson, of Washington; H. L. Cate, of McMinn.

Mr. Remine, of Greene County, said the farmers should take advantage of the law to protect themselves against bird hunters.

Mr. Reef, of Knox, said that the birds were not sufficiently protected. He said that hunters from the city frequently overrun the country farms, and there are many collectors now in the woods robbing birds' nests.

Vice-President R. M. Alexander, of Greene, was called to the chair, while President Meek made an earnest appeal for the protection of the birds.

Mr. Pickle, of Monroe County, explained a plan to destroy insects by means of an insect trap at night.

Mr. Widener, of Union, wanted the gentleman to leave off all big words and tell how to get rid of the cut worms.

Mr. Pickle said to dig up the cut worm and pull off his head.

Mr. Widener said he had been doing that, but the cut worms were more than he was.

Prof. Doran said that if the gentleman would raise toads they would eat the cut worms.

Mr. Widener said he was encouraging the toads for his garden, but he did not have time to raise toads for his corn fields too.

Prof. E. W. Doran said that he had been requested by the Commissioner of Agriculture to continue the investigation of this subject. He asked the assistance of the members of the Convention, and requested that they communicate with him at Loudon.

The next address before the Convention was delivered by Prof. J. W. Glenn, of the University of Tennessee, on the subject of "The Value of Agricultural Experimental Stations and General Experimental Farming." It was a sound lecture, and was listened to with marked attention by the Convention.

Hon. J. B. Stokely, Chairman of the Committee on the General State of Agriculture, submitted his report.

The report was, on motion, received and adopted.

J. K. P. Wallace, of Anderson County, offered the following resolution:

Resolved, That Section 1 of Article IV. of the Constitution, that relates to election of offices and time and place of meeting, be so changed as to read: The election shall be by vote of Vice-Presidents and duly accredited proxies from each county, each Vice-President entitled to one vote.

The resolution was opposed by J. W. Wallace, of Knox, Captain Dunn, of Jefferson, Mr. Alexander, of Greene, and others.

The resolution was lost, there being no votes in the affirmative.

Adjourned to 7:30 P. M.

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NIGHT SESSION.

The Convention was called to order at 7:30 p. m., by the President.

The subject of "Pickles and Vinegar" was made the special topic for the evening. It was introduced and discussed by Mr. Anderson. He showed how a new and profitable industry might be built up in East Tennessee.

Mr. Widener, of Union, made a sensible talk in reference to Knoxville as a manufacturing center and the great advantage the small industries would be to the farmers.

Mr. Anderson, of Knox, maintained that it would be more profitable to farmers to raise potatoes and cucumbers. He thought that an acre of river bottom cultivated in potatoes would be four times as profitable as the same land in corn.

Mr. A. A. Barnes, of Knox, said that potatoes could not be produced profitably on river bottom. He wanted to know if any farmers present had made a success of it.

Mr. Pickle, of Monroe, said that he furnished the river bottom and the seed potatoes to a renter, and he made a total failure for two years.

Col. H. H. Hubbard, of Jefferson, related his experience in potato-raising. He said a farmer could not raise wheat and potatoes at the same time and make a success of both. He said there was money in very early potatoes for the Northern market. To be profitable, this crop must have exclusive attention to produce the first and second crop.

Mr. Taylor, of Anderson, asked Colonel Hubbard why he cut off the end of the potato.

Col. Hubbard said he did not know the reason, but that he had been successful in potato raising and had always cut off the end of his seed potatoes.

Col. T. H. Reeves, of Washington County, did not believe in potato raising. He said what East Tennessee farmers need is grass and more grass and grass all the time. He explained the

success he had in setting a fine upland meadow on poor ground. He mixed his seed, orchard-grass, timothy and Herd's-grass with phosphate, 200 pounds of phosphate to the acre.

The following question was read from the Secretary's desk :

" What kind or kinds of stock should engage the attention of East Tennessee farmers ; mules, cattle, sheep, hogs, or which ? "

The President called upon Mr. Gid. H. Strong, of Knox, to answer the question. He said it depended much upon his tastes, as well as to what his farm was adapted. Mr. Strong made a specialty of cattle, and found that he had better success than in the raising of other stock, while some of his neighbors might be more successful with mules or hogs or horses, while many would be successful in raising all kinds of stock on the same farm.

Mr. Burnett, of Cocke, said the farmer must study his farm and decide what kind of stock it was best adapted to. He thought, however, that sheep-raising would not pay in East Tennessee, on account of the small prices for mutton and wool, and the cost of raising.

J. W. Wallace, of Knox, moved that it is the sense of this Convention that sheep husbandry in East Tennessee is a failure.

Hon. J. B. Stokely, of Cocke, seconded the motion. He said that farmers could not afford to go into the sheep-raising business while there were ten sheep-killing dogs to every sheep.

Mr. Cate, of Meigs County, supported the resolution and showed conclusively that sheep-raising could not pay in East Tennessee under the present condition of affairs.

Colonel Hubbard spoke in favor of sheep-raising. He said that the finest wool that had ever been produced in the world was grown in East Tennessee. He said that it was the farmers' own fault that the country was overrun with sheep-killing dogs. He said that sheep could be raised cheaper than any other stock.

Colonel C. W. Charlton, of Knox, spoke in favor of the sheep. He thought East Tennessee admirably adapted to sheep-raising and made a lengthy argument in support of his position.

Mr. Wallace, of Knox, made a few remarks, to show that sheep husbandry in East Tennessee does not pay, with the present prices for wool and for lambs, and with the distance we are from the markets.

Mr. Cate, of Meigs, said that he did not think his sheep would yield more than one and one-half pounds of wool each, which is worth from 10 to 25 cents.

J. K. P. Wallace, of Anderson County, related his sad experience in sheep-raising. He had found that there was no money in the business, but a positive loss.

Dr. Caldwell, of Jefferson, made a humorous speech on the subject of sheep-raising, and wanted to know if there was any branch of industry in which the farmer could engage.

President Meek said he wanted to sell his sheep, not because it was a losing business, but because he wanted to raise cattle, in which there is more money. He thought it well for a farmer to keep a small flock of sheep. He said the whole matter was resolved to a question of grass.

Col. O. C. King, of Hamblen, arose to a point of order. He objected to the President coming down from his chair to advertise his sheep for sale. [Laughter.]

Captain Dunn said he believed sheep-raising would pay if proper attention was given to the flocks. He did not believe scrub sheep would pay anywhere.

Mr. Cate, of Meigs, gave numerous instances of failures in sheep-raising in his section of East Tennessee.

After some further discussion on the sheep question the subject was closed by Mr. Burnett, of Cocke. He admitted that there might be a little money in raising sheep, but there was more money in almost any other branch of farming.

Capt. Anderson, of Knox County, formerly of Ohio, wanted to know why East Tennessee could not produce sheep and wool as successfully as Ohio. He thought it could be done if the proper attention was given.

Mr. Hardin, of Greene, believed in diversified stock-raising. He favored cattle-raising, but thought there is some money in sheep-raising.

The question was finally withdrawn, and at 10:05 the Convention adjourned to 8:30 o'clock to-morrow morning.

SECOND DAY.

The East Tennessee Farmers' Convention began its second day's session at 8:30 A. M., President John M. Meek in the chair.

Prayer was offered by Rev. L. L. H. Carlock, pastor of the Church Street Methodist Church.

The first topic on the programme was "Does the Jersey Cow Meet the Dairy Interests of East Tennessee?" On this subject the following paper was read by W. Gettys, of McMinn:

MR. PRESIDENT AND GENTLEMEN OF THE CONVENTION: I trust that I will have your patient attention while I present to you, as best I can, my views on this very important subject. No question more concerns the people of East Tennessee than this one, because very much of their future prosperity depends upon its proper settlement and the progress that the dairy interests make within the next ten years.

In nothing has the late war wrought so complete a revolution in this section of country as in its agriculture. Slave labor, in order to be profitable to its owner, required employment through the entire year. This was furnished, principally, by the cultivation of corn in the summer, and in the winter by clearing and preparing new fields for next season's crop.

As old lands were worn out and washed away, fresh fields were cleared and put to corn, and this process went on continuously, with few exceptions, until the soil was exhausted. The corn was fed to mules and hogs on some creek-bank or barn-

yard, where the manure was trampled in the mud or washed away, and the fat stock driven to the southern markets, returning nothing to the land to repay nature for the generous loan she had made.

But you ask, did not our fathers make money by this manner of farming? Yes; but in doing so they robbed the coming generations of their rightful heritage, and the soil of its virgin fertility, and then reinvested the proceeds in more slaves, to be swept away by the war, leaving us with cleaner State escutcheons, but with very empty purses. Thus the end of the war found us with our land impoverished, the slaves set free, and labor disorganized and unreliable. Old methods in agriculture ceased to be profitable; a change must come or bankruptcy follow.

What was the remedy? Evidently it was a diversity of agricultural pursuits, a decrease in the acreage cultivated and an increase in the productive capacity of the soil. This involved a change, in a great measure, from grain growing to the grasses.

At this point the dairying interests, along with others hardly less important, force themselves, almost from a matter of necessity, upon our consideration.

What, let me ask, constitutes the agricultural wealth of East Tennessee to-day? Is it her great crops of wheat and corn? No. Is it her large droves of corn-fed hogs going to the slaughter-pen? No. Is it her fine droves of mules going to Georgia? No. It is her smaller industries; her fruits and vegetables; her poultry, eggs and butter, and other like productions, heretofore considered of minor importance. So far as our section of country is concerned, the large grain crops of our fathers are things of the past; the days of "hog and hominy" are over, and now grass is king and the cow is queen.

Did you ever realize the magnitude of the present dairy business of East Tennessee? I have not the statistics before me, nor would my time permit me to give them in detail, but the shipment of butter alone, to say nothing of the amount consumed at home, is surprisingly large. Yet, can you wonder at this when I remind you of the fact that nearly every tax-payer

is, in a certain sense, engaged in the business, a business that is closely interwoven with all the material interests of our people. The minister, the lawyer, the doctor, the merchant and the mechanic each owns his cow and reaps the benefits of her product, and in this sense each is a dairyman.

What are the demands of the dairy interests of East Tennessee? Is it butter, milk, or cheese that is wanted?

To get at a proper solution of this question, we must take into consideration the population and topography of the country, its manner of farming, its grasses, pastures and market. As I view the question, there can be but one answer to it, and that is, the dairy interests demand a butter cow exclusively.

Aside from the two leading cities of Knoxville and Chattanooga, there is absolutely no market for milk in East Tennessee, and if cheese is wanted it is most profitably produced in connection with a butter dairy. Besides this, our best dairying lands, although fertile and productive, are, as a general thing, too steep and rough for the large milk breeds. Nor have we the heavy pastures that such cows require; but we do have thousands of acres of cheap grazing lands, which, though they do not grow the grasses for the production of large quantities of milk, yet do furnish sufficient for the production of the finest qualities of butter.

For some of the same reasons none of the beef breeds of cattle will suit our dairy interests, and for the more important reason that they, with few exceptions, are not butter makers.

The States outside of us are being rapidly built up and developed, and have all the resources that go to make a people great and prosperous, and for years to come East Tennessee can find a market there for all the good butter she can make at remunerative prices.

The demand for "gilt edge" butter always keeps pace with the growth and prosperity of the country. So we need not fear, with our favorable climate, cheap grazing lands, pure, cold springs and Jersey cows, a want of a market for all of our best dairy products.

Maintaining, as I do, that the Jersey cow is best of all others adapted to our wants, let us inquire into her merits and see upon what she bases her claim as a superior dairy animal. And first, I will ask you to make with me a short visit to the home of the Jerseys.

Between England and France flows the English Channel. In these waters lie the Channel Islands, as they are called, comprising the separate and distinct islands of Alderney, Guernsey and Jersey, the last being the original home of the cattle of that name. Although nearest France, whose language many of the people use, the island belongs to England. Its size is eleven miles long by five and a half miles wide (about the size, if square, of one of your county civil districts), containing an area of 40,000 acres and a population of 60,000 inhabitants.

The farms are small, averaging say fifty acres each, and rent for about \$45 per year per acre, or something like the market price, in fee-simple, of your best farms. The principal sources of income and profit to the inhabitants are their cattle and vegetables, chiefly potatoes. -

They produce neither beef nor cheese, both being imported into the island. Great pains are taken to preserve the purity of blood in their cattle, to secure which the island authorities, more than one hundred years ago, passed stringent laws against the importation into their borders of all cattle from elsewhere, even from her neighboring island, Guernsey, and her parent country, England. The cattle are let out to grass in the morning, tethered to a stake, and at noon moved to fresh grass. This work is done by the women, in whose hands the cows become very docile. The milking is also done by women into a pot over which a cloth is spread and upon which a shell is placed. The milking is done upon this shell so as not to be forced through the cloth and to prevent its rapid wearing. From this shell the milk overflows, and thus is strained as it passes through the cloth into the vessel below.

Now here is a country with 60,000 people in it, with a cow for every two acres of its arable land, the yearly rental value of which is \$45 per acre. What is the condition of it and its peo-

ple? Is it overrun with bankrupts and beggars? No, but on the contrary, the country is, throughout, almost like a garden, with a landscape surpassingly lovely, and its people prosperous, contented and happy.

The Jersey cow has always been valued by the Americans for her great beauty and the richness of her milk, yet it has been comparatively but a few years that she has been properly appreciated as a practical dairy animal. Her grace and beauty aroused the muse of the poet, and moved the brush of the painter. On the lawn of the English nobility she was the pet of the children and the admiration of the visitor.

In short, she was the ideal of the æsthetic in the animal kingdom. But now, without having lost any of these elements of beauty, she has, in spite of gibes and jeers of the beef men and the incredulous old dairymen, risen above the merely sentimental and poetical position, and to-day she stands practically without a rival as a family and dairy cow.

It is not too much to say of her that she has done more in the last ten years to develop and stimulate the dairying and breeding interests in the United States and to demonstrate the wonderful capacity of a good cow to convert food into butter than all other breeds combined within the past century. A score of years ago from 10 to 12 pounds of butter per week was thought an unusual yield for one cow to make; but under the fostering care of the American Jersey Cattle Club, and the pains-taking, and intelligence of the Jersey breeders of America, 14 pounds became the standard; then 20, then 36 pounds were reached, until finally the reading world stood amazed at the enormous amount of 46 pounds 12 ounces of butter from one cow in seven days.

Thirty years ago there were but few of the breed in this country, and \$200 was thought a good, round price for the best, but at the present time, there are about 15,000 living registered females in the United States and Canada, and the sum of \$40,000 has not been considered too much to be refused for one single cow. It is said that the old cow, Eurotas, and her four sons,

represent a value of \$7,500, yet she by no means stands at the head of high-priced cows.

Although but a short time has elapsed since the present system of testing the milk and butter capacity of the Jersey cow was adopted, there are already 700 of the breed that have made records of butter running from 14 to 46 pounds 12 ounces in seven days. And let it be here remembered, to the honor of the Jersey cow and her breeder, that the largest records are the best authenticated. There have been such strict guards against all possibility of frauds thrown around them, that their accuracy is placed beyond a shadow of doubt; so, as wonderful as they are, we are forced to believe them. The largest butter record in the world was made in February last, when the thermometer was often at or below zero, by the Jersey cow Princess 2d, of the Coomassie family. From 300 pounds of milk she produced 46 pounds 12 ounces of butter in seven days, or about five and one-half gallons of milk and six and one-half pounds of butter per day. The next largest test has been made since that time, by another Jersey cow, Oxford Kate, also of the Coomassie family. This cow produced — pounds of milk, 13 pounds 12 ounces of butter in seven days. Mary Ann of St. Lamberts, of the Stoke Pogis-Victor Hugo family, has a record of 36 pounds 12 ounces of butter in seven days, and 867 pounds 14½ ounces in eleven months and five days. These cows weigh about 1,000 or 1,100 pounds. The cow giving the richest milk on record in the world is Lancaster Fancy, owned by the Columbia Cattle Company, of Middle Tennessee. From an average of two gallons of milk per day she made an average of three pounds of butter. The largest, and perhaps the most wonderful, yearly yield of butter by any cow of any breed, has just been reported. It was made by the Jersey cow Masena, No. 25,732, owned in New York. Her record for one year and fifteen days, is 902 pounds and three ounces.

Now, lest some anxious friend of the Jersey cow should think that she produced this great amount of butter at a financial loss to her owner, let me give you the exact account for the whole time, as kept by him, and see if it does not pay to keep a good cow:

Masena's account for one year and fifteen days, current prices here :

To 1500 lbs. middlings, at 1¼c. per lb	\$18 75
To 1600 lbs. corn-meal, at 1¼c. per lb.....	20 00
To 1100 lbs. barley-meal, at 1¼c. per lb.....	13 75
To 600 lbs. bran, at 1c. per lb	6 00
To 450 lbs. ground oats, at 1¼c. per lb.....	5 62
To 30 bu. small potatoes, at 25c. per bu	7 50
To 1800 lbs. hay, at \$12 per ton	10 00
To pasturage.....	10 00
<hr/>	
Total	\$99 42
902 lbs. 3 oz. butter, 30c.....	270 65
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Net profit.....	\$128 23

Counting the milk worth the expense of handling the cow, there is clear profit on the butter alone of six per cent. interest on our \$2,000, to say nothing of the value of her calf, which would be at least \$1,000, regardless of its sex.

The friends of the Jersey cow have never claimed her as the largest of milkers, but have been content with her unequalled butter performances. She has, however, some creditable milk records. The cow Ida of St. Lamberts, in her test of 30 pounds of butter, gave 65 pounds or 8 gallons of milk per day. Princess 2d, in her great butter yield, gave 5½ gallons per day, from which it took less than one gallon to produce one pound of butter.

A number of other reported cows have done equally as well in milk production. It is true that the dairy yield of milk of any Jersey cow has been exceeded by members of the Holstein breed of cattle, the largest milkers in the world. Yet considering the persistency of the Jersey to hold out in her milk from year to year, and calf to calf, it is doubted if the yearly yield of the average herd, of any other cattle, will be greater than from an average herd of good Jersey cows.

In commending to the favorable consideration of this Convention the Jersey cow as one of all others best adapted to the wants of the dairy interests of our section of country, I do not mean to say that every man should own and breed nothing but the pure blood, for I am aware that this is beyond the means of some, and there are comparatively few men that would make successful breeders of thoroughbred stock, but I do mean to say that every one wanting to produce the finest quality of butter at the least cost should own the blood, either pure or mixed. Any farmer who is able to keep dairy cows, can, by the judicious use of thoroughbred bulls, on the best native cows of the country, in a few years build up a herd of practical butter cows that will both be a pleasure and a profit to him—some of the very best family and dairy cows of the country are grade Jerseys.

If you are able to own a cow, it is just as cheap to keep a good as a poor one. Let this be an axiom, No poor man is able to own a poor cow.

In concluding this paper let me say that the Jersey cow lays no claims to beef, and taken as a rule, no good dairy breed is a good beef breed, for the very qualities that make them superior in the dairy, renders them unfit for the shambles.

Having taken the position that the dairying interests of East Tennessee demand strictly a butter cow, I will here formulate three claims that the Jersey cow makes.

1. She is the best butter cow in the world, and will make more butter from a given amount of feed than any other.

2. She will make the best butter in the world considering flavor, color and texture.

3. She is better than any other cow adapted to the light pastures and cheap grazing lands of East Tennessee, and from the sweet and nutritious grasses upon your steep and rugged hillsides where the larger breeds will not thrive, she will, of all other cows, bring you the richest harvest of her golden butter.

For these and other reasons I present her claims to the dairy interests of East Tennessee, with full confidence that she will meet their demands in an eminent degree.

The paper was discussed by Messrs. C. W. Charlton, Major T. S. Webb, J. V. Fulkerson and Colonel G. W. Mabry, of Knox.

A resolution was offered by Mr. Gettys, of McMinn, asking the Legislature at its extra session to pass the pleuro-pneumonia bill now pending. The resolution was unanimously adopted.

The next topic on the programme was "Horticulture in East Tennessee." Frank J. Bennett, of Hamilton, who had been appointed to read the opening paper on this subject, was not present.

Mr. J. H. Pickle, of Monroe, introduced the subject in an able address. He was followed on the same subject by Messrs. Cate, of Meigs, Mabry, of Knox, McCroskey, of Monroe, Klepper, of Blount, and Dr. Bond, of Knox.

J. W. Wallace proposed for membership Colonel William Rule, editor of the *Journal*.

The motion was seconded by President Meek, Colonel Charlton and others.

Colonel Rule was unanimously elected, and tendered his thanks for the honor.

President Meek, on the subject of horticulture, said that many farms in East Tennessee are adapted to little else but fruit-raising. He gave an instance of the success of a farm in James County in raising grapes. He planted grape cuttings in a poor twenty-five acre field and the next year sold \$1,500 worth of grapes.

Mr. Pickle, of Monroe, closed the discussion. He did not believe in sowing any kind of grass in the orchard.

Col. J. W. Gaut, of Knoxville, was present and read a petition to Major Fink, Receiver of the East Tennessee, Virginia and Georgia Railroad asking for more favorable rates on dried fruit.

Col. Gaut explained that this petition originated with a firm in Rogersville, and was being urged by merchants all along the line, and by others in the interior.

Col. Charlton moved to indorse the petition, and that the officers of the Convention be requested to sign it.

Col. Hubbard moved to amend by directing the President and Secretary to interview Major Fink on the subject, and urge upon him to **grant** the petition.

On motion of Col. O. C. King, of Hamblen, the matter was referred to a committee of three, to report in the afternoon.

The chair announced Col. O. C. King, of Hamblen, C. E. Dunn, of Jefferson, and C. E. Pickle, of Monroe.

The Convention adjourned for fifteen minutes to inspect Col. Dickinson's fine cattle and Col. McGhee's fine horses.

After the Convention was called to order, Professor J. W. Glenn, of the University of Tennessee, Chairman of the Committee on "Quarries and Lumber," presented an able and exhaustive report on the subject. The report was adopted by the convention unanimously.

The next paper read before the Convention was by Col. C. M. McGhee, of Knox, on the subject of "Holstein Cattle." Owing to the indisposition of Col. McGhee, his paper was read by Col. Charlton, as follows :

TO THE EAST TENNESSEE FARMERS CONVENTION: Your essayist on Holsteins, feeling that the object of this appointment was to give to the members of the Convention information with regard to this breed of cattle, is of the opinion that this may be attained better by submitting what has been written by those who have for a longer time been giving attention to the subject than by giving his own views and experience, which has been limited to a few animals.

I have thought best to give to the Convention the observations and views of persons more fully acquainted with the Holsteins than I. I submit the address read by T. N. Figures before the Tennessee Stock Breeders' Association, February 3.

After making copious extracts from the above address, Col. McGhee concludes as follows :

Nine heifers and two bulls have been brought to Knox County, and a heifer and bull to Blount County. C. M. McGhee, six heifers and a bull; Strong Bros., two heifers; C. W. Charlton, one bull; University of Tennessee, one heifer.

All the heifers above mentioned have dropped calves at two years old, and are giving large quantities of rich milk.

The six heifers (C. M. McGhee's) are giving from $4\frac{1}{2}$ to $5\frac{1}{2}$ gallons of milk a day. For the month of April they produced something over a pound of butter each per day, as the average, without special attention, beyond good pastures and a little bran.

Prof. Bartlett brought a bull and heifer to Blount County that are said to be fine.

The heifer on the University farm has been tested and is giving satisfactory results.

Some specimens of this stock will be exhibited to members of this Convention.

In conclusion, your essayist will state that while in his opinion the Holstein, as a producer of rich, nutritive milk, is generally recognized as superior to any known breed of cattle, he is not prepared to present them as the equal of the Jersey as a butter cow. Our experience, as said above, has been limited, and we had thought best to give what others have published.

At the conclusion of the reading of Col. McGhee's paper the Convention adjourned to 1:30 P. M.

AFTERNOON SESSION.

The Convention came to order at the regular hour.

While tardy members were finding their seats, Col. C. W. Charlton, on behalf of the Committee on Immigration, read the committee's report, which had a very encouraging tone, and will be produced in Commissioner McWhirter's immigration circular.

Prof. John W. Glenu then asked to present the report of the Committee on Quarries and Timber. It proved an entertaining and instructive paper. It will be published and circulated by Commissioner McWhirter.

The hour having arrived, the Convention went into the election of officers for the ensuing year. Col. John M. Meek was re-elected President, Mr. J. K. P. Wallace was elected Secretary and M. H. Cate Assistant Secretary.

The Committee on Fruit Shipping, appointed in the morning, asked to report through the Chairman, Col. O. C. King. In presenting the report, Col. King made an able speech. Their report is as follows:

MR. PRESIDENT AND GENTLEMEN: Your committee, to whom was referred the question of securing transportation rates for the prospective fruit crop in East Tennessee, would respectfully report that the result of our deliberations is embodied in the following resolutions, which we submit and recommend to be adopted by the Convention:

Resolved, That the President and Secretary of the Convention be, and they are hereby appointed a committee to wait upon and confer with the receiver of the East Tennessee, Virginia & Georgia Railroad Company, or such officer as may have authority to act in the matter, and with the proper authorities of other railroad companies, and secure, if possible, modified or reduced rates from all points in East Tennessee upon shipments of fruit, both green and dried, to the principal fruit markets of the United States.

Resolved, That our said committee be, and it is hereby instructed to publish, or cause to be published in the newspapers at Knoxville and other points in East Tennessee, the schedule of freight rates it may be able to arrange for, both with the authorities of the East Tennessee, Virginia & Georgia Railroad and with other roads, so that all persons interested in the growing and shipment of fruit may stand upon an equal footing as regards a knowledge of the freight rates.

Resolved, That this schedule of freight rates be published as soon as practicable, so that it may become generally known before the opening of the fruit season.

All of which is respectfully submitted.

O. C. KING,
J. H. PICKLE,
C. E. DUNN,
Committee.

The topic of Shorthorn cattle was then discussed, on which Col. J. M. Jones, of Monroe, and Col. S. E. Young, of the same county, both made excellent speeches.

Mr. Jones said in substance:

MR. PRESIDENT AND GENTLEMEN OF THE CONVENTION: The President appointed me some two or three months ago to lecture on Shorthorn cattle, and I immediately wrote him to appoint Col. James R. Love in my place, and Col. Love expected to be here, and why he is not here I can't tell. I know nothing about the history of the Shorthorn cattle, and but very little about them anyway. In 1879 I went to Kentucky and bought a few head of Shorthorn cattle, and have been breeding them ever since, and I am very well pleased with the Shorthorn. I have made more money out of them than I could have made out of scrub cattle, and I think any man can do the same. Some people think the Shorthorn cattle do not milk well. I know I have some good scrub milkers and some half Jerseys, and the Shorthorn gives about as much milk, and if they lack anything in quantity they make it up in quality. It is further said by some that they are harder to keep. I have thoroughbreds, mixed Shorthorns, half Jerseys and some scrubs, and they are all fed alike, and one goes through the winter as well as the other. My Shorthorns get no better treatment than my scrub cattle, and I believe for all purposes that the Shorthorn is the best breed for the farmer, and I am certain that if you will take the same pains with the Shorthorn that is taken in Jerseys and Holsteins they will produce as good

milk and about as much butter, and I am satisfied that if ever there is as many Jerseys or Holsteins the price of the Short-horn cattle will be as high as either.

The Secretary then read Commissioner McWhirter's address, owing to that gentleman being unable to attend the Convention. We publish it here in full :

"I am the State!" was the proud utterance of Louis XIV—*le grand Monarque*—and around this formula have crystalized the autocratic systems of the world. All the bitterness, all the rebellion, all the riot and ruin and revenge that darken the history of every monarchy sprang from this—the far removal of the interest of the people from the interest of the crown. If there be anything in the genius of our Great Republic which more than all else differentiates it from all other governmental systems in the world, it is that her political leaders, from the Chief Executive to the most subaltern city official, are the creatures of the people—"the children of the soil," as the old Roman has it—identified with the industries, as well as dependent upon the revenues of the country that they serve. Few, indeed, are the men of mark that have shone in the galaxy of American greatness whose hands have never touched the plow, or whose early life has not been moulded by industry and ennobled by honest toil. It is, therefore, a natural corollary from this that the representatives of the American people should feel incumbent upon them as the first duty of their official life to vigorously stimulate and liberally sustain, by every possible measure, the interests of industrial life. The grand old maxim, that the people who are least governed are best governed, sprung naturally from the intimate relations which, under our political economy, exist between the interests of the people and their chosen representatives in the official functions of the Nation.

The people of the United States are an essentially agricultural and industrial people. Our great men have caught the inspiration of their lives from the crystal ribboned mountains and the fertile valley, from the ring of the anvil, the smoke of the furnace and the buzz of the factory and the mill. Hard-handed and sun-browned, they enter the seats of the rulers with a sym-

pathy of feeling and identity of interest that ambition cannot obliterate nor political chicanery entirely suppress—a heaven-patented nobility, whose badge of knighthood is the shining plowshare and whose chariot of triumph is the whirring reaper.

“Compare,” says Cowley, in his *Essay on Agriculture*, “the original and primitive nobility of these great persons whose names are uttered in reverence and fear, with the tinsel, shallow show of glory, which makes them too proud now not only to till the ground, but almost to tread upon it. We may talk as we please of lilies and lions rampant, and spread-eagles in fields and argents; but if heraldry were guided by reason, a plow in a field arable would be the most noble and ancient arms.”

But, with all our consanguinity of industrial and political interests, there is a remarkable want of systematic legislation for the support and development of agriculture and industry throughout our land.

So fertile is our soil, so exhaustless and varied our resources, that much has been left to individual effort, the necessity for governmental aid in bringing out the possibilities of the country not being so keenly felt as in other lands where the highest resources of science are taxed to their utmost to enlarge the capacity of development in an unfriendly and exhausted soil. But since the establishment of National and State Bureaus of Agriculture and Industry the progress of material development has been the marvel of the world, and every dollar expended by the State in the furtherance of her internal agricultural and industrial interests has been multiplied a thousand fold. Individual effort is powerless to attain general developmental perfection without organized system. This is the law of creation. When the first fiat of the Creator went forth, calling into existence the wondrous forms of Nature, there was a grand panorama of universal system. Order was everywhere. Species gathered individuals; genera gathered species and the march of the universe kept time to the drum-beat of universal law. And in all developments organized system is an absolute necessity to destined perfection. Whatever may be the capacity or energy of any individual, his efforts are lost to the general developments unless sustained by organized support. As the rep-

representative of the interests of the country at large, it is therefore the bounden duty of government to thoroughly systematize and liberally support all the material resources upon which all governmental integrity depends for very existence.

The relation of the State to all its interests is manifest :

1st. In stimulating energy.

2d. In accumulating fact.

3d. In disseminative knowledge.

1st. In stimulating energy. The impetus to labor is always commensurate with its outcome. "In the sweat of thy brow thou shalt earn thy bread" was the forfeit of the fall. And yet, for necessity alone, man need only touch the earth and its great *thesaurus* displays its treasures to the open sesame of his genius. But savage history has proven to us that only within the realm of necessity will physical impulse operate, if no higher sentiment be introduced by the philosophy of civilization. The satisfaction of the daily needs of the physical organism is the *summum bonum* of the savage. The cultivation of the soil for ends higher than individual sustenance is unknown to barbarism. Civilization points to higher purposes. The cultivation of the soil, and the production of material for human sustenance, beyond the needs of the individual in whose immediate interest it is done, looks to a higher end. It means the development of other interests, the interchange of which make up the commerce of the world—make education a possibility, and society an evolving factor in universal progress. But to this end the governmental support is not only natural, but necessary. It is in governmental representation that internal resources are compared and the needs of development intelligently expounded. It is the duty, therefore, of every representative government to so order and regulate its policy as to bring it in the most thorough sympathy with the highest development of its resources. And in a country like ours, to which great political economists have ever pointed as the future granary of the world, I ask, is there any interest that should demand a stronger support or call for higher material stimulation than the agricultural interests of this heaven-favored land?

Not for our own immediate needs is a stimulation to energy required, but in the proper support of agricultural interests you lay the foundation for the highest structure of development that the universe has ever yet beheld.

It is well conceded that agriculture is the great substratum of governmental strength, of national wealth, and of political integrity. It is the fulcrum upon which the great lever of commerce rests—the very palladium of a nation's strength. It is the most ancient, the most universal, and the most important of the arts. Since Cain, "the tiller of the ground," and Noe, "the husbandman," agriculture, the basis of all other arts, has ever been in all countries coeval with the first dawn of civilization.

Among us agriculture is the great foundation of national prosperity. The vast territory of the United States presents every variety of soil and climate. Its agriculture embraces all the products of European cultivation, together with some of the warmer countries, as cotton, sugar and indigo. Our agricultural implements are in many respects similar to those of Great Britain and France. But, as a general rule, it is conceded that those of the United States exceed all others in their wonderful adaptation of machinery for all purposes of cultivation and harvesting of crops. So successful have been our farming implements in repeated contests on European soil, that their rapid introduction into foreign markets is only impeded by the increasing demand at home. The disposition of the American to experiment, to test alleged improvements and adopt labor-saving expedients, gives a great impulse to the genius of inventors, as may be seen by the number of agricultural patents granted, which in 1847 was but forty-three, and during the last ten years thousands have been issued. This mental activity of the American farmer, so much in contrast with the blind opposition of the European countrymen to any improvement, is owing, in great part, to the superior intelligence of the former, developed by the philosophy of republican institutions. In Europe land is dear and labor cheap; but in the United States the reverse is the case, hence the European cultivator is led by a regard for his own interest, to endeavor

to make the best of his land, while the American has the same inducements to reduce to the lowest possible minimum the proportion of manual labor employed in its operations. Unhappily for us, this principle is too often carried to a disastrous extreme. A man, possessor of a large estate, with reduced means, believes it necessary to scratch over the whole, when his assurance of success would be to concentrate his labor upon a small area. Another cause of deterioration of soil, quoted as a warning in the reports to Congress, is the cheapness of western lands, the original price of which bears such insignificant proportions to their intrinsic value that the owner, after having taxed the soil for immediate results, deems it cheaper to remove to new lands than to sustain and increase the productive capacity of his present farm. One result of this error is the removal westward year by year of the center of wheat production, thus adding transportation and other charges to its ultimate cost, threatening to render export next to impossible. But the immediate consequence of this indifference for conservation or fertilization of soil is, that with land generally much richer than that of European countries, the average production of America remains far below that of any country in Europe. Such meager results, as may be seen by reference to statistical tables, indicate plainly the wastefulness and want of system in the practice of a majority of American farmers.

But the increasing interest of the American people in the advancement of the agricultural science and their growing inclination to employ in agriculture capital, business energy and active enterprise, will, if supported by legislative aid, soon counter-balance the causes of this apparent inferiority.

2. And again, it is the duty of the State to accumulate, classify, and preserve all facts that look to the development of agricultural and progress of industrial life. The loss to the world by neglect of this has been incalculable. Discoveries, processes, results, have sunk into oblivion that might have been great factors in the healthful development of industrial and agricultural science. Organized bureaus, well-stocked museums give to the world a perfect panorama of agricultural and industrial history. How suicidal the policy that would neglect or embarrass them?

3. And besides all this, it is the duty of the State to provide adequate means for the dissemination of knowledge upon all agricultural and industrial subjects. Of late years the establishment of agricultural colleges, under the auspices of the State has done much to give stimulus to agriculture and expand the scope of its operation. But these—grand as they are in the economy of the future—do not meet all our needs. A well-organized and operative agricultural bureau, under the direct control of State patronage—a very part of State polity—touches the masses of the people, the yeomanry of the land. It brings right to their very doors the information they need in expanding and developing the great interests on which the vital integrity of the State depends.

Cowley, to whom I have in this address before referred, has thus adumbrated the possible future of agriculture under a regulated system of governmental support:

“The utility (I mean, plainly, the lucre of it) is not so great now in our nation as arises from merchandising and the trading of the city, from whence many of the best estates and chief honors of the kingdom are derived; we have no men now fetched from the plow to be made lords, as they were in Rome, to be made consuls and dictators; the reason of which I conceive to be from an evil custom, now grown as strong among us as if it were a law, which is that no men put their children to be bred up apprentices in agriculture, as in other trades, but such who are so poor that when they come to be men they have not wherewithal to set up in it, and so can only farm some small parcel of ground, the rent of which devours all but the bare subsistence of the tenant; whilst they who are the proprietors of the land are either too proud, or, for want of that kind of education, too ignorant to improve their estates, though the means of doing it be as easy and certain in this as in any other track of commerce.

“If there were always two or three thousand youths for seven or eight years bound to this profession, that they might learn the whole art of it, and afterwards to be enabled to be masters of it by a moderate stock, I cannot doubt but that we

should see as many aldermen's estates made in the country as now we do out of all kinds of merchandising in the city.

"There are as many ways to be rich, and which is better, there is no possibility to be poor, without such negligence as can neither have excuse nor pity; for a little ground will, without question, feed a little family, and the superfluities of life (which are now, in some cases, by custom, made almost necessary) must be supplied out of the superabundance of art and industry, or contemned by as great a degree of philosophy."

Golden words are these! If true, in England's crowded fields, how infinitely more significantly do they appeal to us, even at this day, from the shadowy days of the seventeenth century!

It is impossible for me, in the scope of an address like this, to fully elaborate the relations of the State to industry and agriculture, but I cannot close without a personal appeal to you, the representatives of that sphere of life which makes the greatness of a country possible, and the neglect of which is sure to be followed by national decay.

Let me ask this one question of the yeomanry of Tennessee: For what do you elect your Representatives that sit from year to year in yonder marble temple—the Acropolis of modern times? Are they there to fritter away the time that should be devoted to the great interests of your State in political bickerings and angry contentions? Is it for this that you call them to positions of honor and stations of social and official distinction? You men of Tennessee, on whose fertile soil the sun of heaven shines as though the God of the universe recalled the Eden of his first creation, can you rest quietly under any representation that fails to recognize the stupenduous interests which it is yours to sustain, and for which you have an inalienable right to expect an adequate support?

The flash of rhetoric and the storm of political discussion can never fulfill for you the object and aim of representative government. You want less of political form and more of political substance. You want men from your own sphere of

industrial life to stand by your interests and to further the great fundamental principles of national prosperity, on which all governmental integrity must ever rest.

The time has come when the people will not be satisfied with political leaders who fail to recognize their interests in the great functional relations of representative government. Too much of our country's history has been wasted in unavailing political strife. Too little of our legislation has had for its purpose the support of industry and the development of the people's interests. To the credit of our present administration, be it said, the foundation for a solid agricultural and industrial future for our State has been firmly laid. Let this good work go on, until the electric thrill of industry shall energize your State, and the paralysis of industrial interest shall be no longer felt throughout the borders of your land.

A vote of thanks was tendered Commissioner McWhirter for his continued interest in the Convention.

The following resolution was offered by Mr. J. W. Wallace :

Be it Resolved, That this Convention acknowledges and appreciates the presence during this term of the ladies here named : Miss Sarah Sword, New Castle, Pennsylvania ; Miss Agnes Barnett, Washington, Pennsylvania ; Miss Ada B. Meek, Knoxville ; Miss Mary E. Meek, Fancy Meadows, Tennessee ; Mrs. J. M. Heiskell and Mrs. R. F. Scruggs, Sweetwater, Tennessee ; Miss Annie Lewis, Loudon.

Mr. J. K. P. Wallace offered the following resolution :

Resolved, That it is the sense of this Convention that the multiplying numbers of insects injurious to vegetation is such as to seriously threaten to interfere with the profitable growing of the farmers' crops, and even work their injury after the crops are harvested, and also with the growing of our valuable timber, and recognizing as we do the valuable services of the birds in their destruction of these insect pests we do most emphatically demand that our incoming Legislature enact such laws as will give the insect-eating birds of East Tennessee complete pro-

tection from any interference during their breeding season, and to strictly prohibit the exportation of birds beyond the limits of the State.

NIGHT SESSION.

The Convention was called to order at 7:50 P. M.

Col. C. W. Charlton renewed his request for information in regard to a good location for a creamery. A Pennsylvania man is making inquiries in regard to establishing a large creamery in East Tennessee. It must be in a locality where there is abundance of good spring water, and where there are from 300 to 500 cows in the neighborhood.

President Meek said that Mr. Hood Franklin, of Jefferson County, is about establishing a creamery, and proposes to start with milk from sixty cows.

Col. O. C. King thought that Morristown would be a good location for a creamery.

Captain Adams, of Ohio, said that there were a hundred good places in Knox County suitable for creameries. He said the main point was to secure the milk. In the North, the creameries pay the farmers ninety-five cents a hundred pounds for milk.

Mr. Widener said he lived in a valley of Union County, thirty-two miles from Knoxville, and thinks that valley is well adapted to this industry as it is naturally a fine place for blue-grass.

Dr. D. J. Eggleston, of Minnesota, explained the creamery industry in the Northwest, and said that East Tennessee was a much better country for the industry; in fact, he thought it the best in the United States.

The Secretary read the following report, which was unanimously adopted :

We, the committee appointed to visit the experimental farm in connection with the University of Tennessee, report that they were courteously met by Prof. J. W. Glenn with conveyance and conducted to the grounds, and were kindly shown

through the experimental grounds. The Professor took particular pains to point out and explain the workings and operations of that farm. They found the stock in good condition and of a high quality of merit. The different kinds of cattle, embracing Jerseys, Holstein, Shorthorn and Devon were represented by splendid specimens.

The growing crops are in a high state of growth and promise an abundant harvest, excepting wheat, which, owing to the very unpropitious winter does not promise a profitable crop, but is rather above the average. The wheat is grown under a series of experiments hitherto inaugurated. Upon the general outlook, we are encouraged to think the management intend to comply with the conditions and requirements of the law creating and endowing these agricultural schools. We hope to see the institution attain a just degree of popularity and efficiency.

Respectfully submitted,

H. L. CATE,
B. M. EWING,
J. W. ANDES,
J. C. MURRAY,
J. W. PAYNE,
Committee.

Professor Glenn, of the University of Tennessee, asked that the farmers would communicate with him and advise him of any experiments they would like to have made.

The special order for the night session was the address of Hon. W. A. Henderson, of Knoxville, on "The Law of the Farm." It was a most excellent extemporaneous speech, and was listened to with marked attention.

On motion of Prof. J. W. Glenn, a vote of thanks was tendered Colonel Henderson for his address, and a copy requested for publication in the proceedings of the Convention.

Colonel Henderson stated that his speech was not written, but that he would try to write something on the subject which would be better than what he had said.

The Secretary read the following list of Vice-Presidents which President Meek has appointed for the ensuing year :

Anderson County—Orville Taylor, Clinton.

Blount—E. Goddard, Maryville.

Campbell—R. D. Wheeler, Careyville.

Claiborne—E. P. Caywood, Tazewell.

Carter—Joe McCorkle, Elizabethton.

Cocke—J. J. Burnett, Big Creek.

Greene—R. M. Alexander, Greeneville.

Grainger—A. X. Shields, YZ.

Hancock—A. J. Tyler, Sneedville.

Hamblen—C. V. Taylor, Russellville.

Hawkins—H. B. Clay, Rotherwood.

James—George O. Cate, Ooltewah.

Knox—J. G. Gillespie, Beaver Dam.

Loudon—Wm. Cannon, Loudon.

Monroe—J. H. Pickle, Sweetwater.

Morgan—M. Stephens.

McMinn—John C. Cate, Mouse Creek.

Polk—E. Dunn, Cog Hill.

Meigs—W. B. Brown, Georgetown.

Sevier—J. W. Andes, Sevierville.

Rhea—B. M. Ewing, Carp.

Sullivan—J. F. Massengill, Union.

Roane—W. T. Gallaher, Gallaher's Mills.

Unicoi—George Swadley.

Washington—A. S. N. Dobson.

Jefferson—J. J. Hubbard, Mossy Creek.

Marion—Wm. Owens.

Union—T. M. Widener, Acuff.

Hamilton—E. A. James, Chattanooga.

COMMITTEES. *

On Programme—J. B. Stokely, of Cocke; A. S. N. Dobson, of Washington; George O. Cate, of James.

General State of Agriculture—J. A. Goddard, of Blount; Wm. Rule, of Knox; J. F. Massengill, of Sullivan.

Immigration—C. W. Charlton, of Knox; W. B. Brown, of Meigs; W. Y. C. Hannum, of Blount.

Manufactures—O. P. Temple, of Knox; H. B. Yearwood, of Monroe; J. F. Bell, of Cocke.

Quarries and Lumber—Swan L. Burnett, of Cocke; — Norcross, of Anderson; J. W. Glenn, of Knox.

New Business—J. M. Heiskell, of Monroe; Robert Brice, of Knox; J. J. Hubbard, of Jefferson.

On Arrangements—Capt. Wm. Rule, J. W. Wallace, R. W. Austin.

On Live Stock—W. Gettys, of McMinn; J. M. Jones, of Monroe; G. H. Strong, of Knox.

On motion of J. W. Wallace, a vote of thanks was tendered the Secretary of the Treasury, Hon. Daniel Manning, for granting the use of the United States Court-room to the Convention; also to Senator Harris for his influence in securing the room, and to other officials who had assisted.

The President of the Convention appointed J. W. Wallace and Secretary J. K. P. Wallace to address suitable letters of thanks to Secretary Manning and Senator Harris.

Votes of thanks were also tendered to the President and to the retiring Secretary, J. W. Wallace, of the *Tribune*; to the railroads, to the press, to Professor Glenn, of the University of Tennessee; to Col. Perez Dickinson, to Colonel McGhee, to Mr. Jacob L. Thomas, to the proprietor of the steamer Water Lily and to the steam plow men.

The Convention then adjourned to May, 1886.

AN ADDRESS

DELIVERED TO THE COLORED PEOPLE AT THE FAIR GROUNDS IN
TRENTON, ON OCTOBER 20, 1885, BY HON. A. J. McWHIRTER,
COMMISSIONER OF AGRICULTURE, ETC., BEFORE A
LARGE AND APPRECIATIVE ASSEMBLY.

It is with a thrill of peculiar pleasure that I appear before you upon this occasion, which is so voiceful of your past development, and so prophetic of your future. Cast your eye back over the wonderful panorama of events which have made the history of the past fifty years, and you will behold a succession of wonders—strange, stupendous and startling. Then the canal which stretches from lake to river was still the main avenue of transit eastward and westward through the Empire State. Beyond that the steamer and the stage-coach held sway. The grosser products of the West consumed themselves before they reached the Eastern market. The cattle and swine stretched away in endless droves across the States lying eastward of the Mississippi. The sustentation of these while on the way to the Eastern market enriched the farmers along the route more than those who reared and drove. Cheese sold at the ports of Lake Erie then at 3 cents a pound. Tens of thousands of fat sheep were annually slaughtered in Ohio for the hides and tallow—only the hams and tongues being saved for food.

The West was open; was known to be full of possibilities. It teemed with food, but yet was poor. The East was at its zenith. Every industry was quick. Labor was in abundance and yet in demand. Wages were low and so were supplies. There were few centers of population and still fewer unoccupied arable lands. Life and labor were evenly spread over the whole country. The land was a bursting hive—a magazine of possibility. In the South illimitable fields bore their snowy fruit by the labor of dusky hands on which the hard hand of destiny had fastened the chains of bondage. We were still a

nation of hand-workers. There was not a mower or a harvester or a horse rake then in existence. No house contained a sewing machine. The telegraph, ten years later, began at Washington and ended at New York. The land was lighted with candles after nightfall. The spinning wheel and shuttle sounded in every farmer's house. Butter was unmarketable a hundred miles from the dairy. The steam saw mill had just begun to devour the forests. From East to West was the pilgrimage of a life; from North to South a voyage of discovery. The epoch of haste had not come. The sun rose quietly and set at leisure. A day's journey was a serious matter. The canvas-covered wagon was the ark of trade. The saddle was the emblem of speed. Men slept yet in their beds. The day began with the dawn, not with the train's arrival. The turnpike was still the great artery of trade. The highways were dusty and populous. There was time to live. Brawn and brain went hand in hand. Every life touched nature. Like Antæus, we felt the earth beneath our feet and were strong. We had vanquished Nature, and sat by the Indus of Time weeping for other worlds to conquer.

It was not long to continue thus. Already the footsteps of the prince were at the portals of the silent palace. The age of miracles were about to dawn. The first railroad was already in operation, and within two decades the gold of California, the telegraph, the mower, the thresher, the sewing machine, petroleum gas—oh! so many wonders, that they that wrought before forgot their cunning and learned anew to guide rather than to do, to stand by and direct the goblins, whom science had evoked from earth and air and sea, to do their bidding. And now the fullness of time had come. Four years of anarchy and bloodshed, of cruelty and waste, of anguish and of gloom. Old ideas were overthrown, old institutions broken up, old antagonisms subdued and old prejudices set aside. Out of the eater came forth meat and out of the strong came forth sweetness.

Peace came and with it a new lease of the Nation's life. That which in the cataclysm of war was a national policy became a factor of national destiny. The fiat had gone forth, and *your*

people sprung, Minerva-like, from the brow of Liberty to take their places as freemen in the ranks of American citizenship. Many were the misgivings, many the gloomy prognostications and malevolent expressions which greeted you on the birthday of your freedom. With the enthusiasm of children on a gala day you rushed into political life. You drank deep draughts at that fountain of freedom, the ballot-box, and in process of time you found them, like Ezekiel's brook, sweet to the taste, but bitter as gall when swallowed. It brought you no emolument, it guaranteed you no rights, social, civil or political, for your people were poor, helpless and dependent—unable to cope with wealth, wiliness and wisdom. You put forth your hand to pluck the fruit of freedom and found nothing but leaves.

A new light burst upon you. You saw that in bygone days it was your labor that had enriched the land, your hands that filled the coffers of commerce and the sweat of your brows that had distilled wealth and culture upon the people whom you served. You looked at all this and saw that that labor would bring the same to you; that what your fathers had done for others you might do for yourselves, and you turned your energies to the accomplishment of this end. This assemblage here to-day indicates that you have chosen well. I am no prophet, nor the son of a prophet, but I tell you to-day, colored men and women of Tennessee, the inaugural of this Agricultural Fair is the *avant courier* of a glorious destiny for your race.

In the wake of industry will follow all that dignifies the character, that ennobles the person and entitles him to honor among his fellows and recognition by the world. Do you wish influence? Industry, sobriety and honesty will command it. Do you crave power? They will confer it. Do you covet renown? Industry will make it possible. Do you want wisdom? Industry and economy will grant you means to procure it. And then will follow all the possibilities of development under the consciousness of independence, self-conceived and self-attained, which no frothy debate could ever bequeath and no political trickery accomplish.

My colored friends, be temperate in all things; be also practical in all things. Learn wisdom from the lessons of the past. Make money and take care of it.

"Not for to hide in a hedge,
Not for a train attendant,
But for the glorious privilege
Of being independent."

No man is a *free* man who is penniless. Poverty is the worst of thralldom. Upon your race to-day its chains rattle with gloomy and ominous sound. No President can sign them off. It is for you to rise in your power and break these fetters as Samson did the Philistines' withes.

I congratulate you in the name of the State of Tennessee upon this inaugural to-day. Go forward with your noble work of agricultural progress. Acquaint yourselves with the the mechanics. Learn to build ships, locomotives, electrical and agricultural machinery. Leave the noxious vapors that rise from the seething cauldron of political corruption and breathe the fresh air of God's heaven-kissed fields. Peace and plenty will smile upon you, culture and influence will come within your grasp, and in the right of your inheritance, you will prosper in the land, sitting under your own vine and fig tree, none daring to molest or make you afraid. God speed you in your work of progress and bless you abundantly with all that hallows and beautifies and ennobles life, is my earnest and heartfelt prayer.

ADDRESSES DELIVERED BY TENNESSEANS

—AT THE—

Southern Immigration Convention

—AT—

NEW ORLEANS, LA., MAY 10, 1885.

ADDRESS OF GEN. WILLIAM G. BRIEN, LL.D.,

OF NASHVILLE TENN.

Two or three days ago I received your invitation to address you. The brief notice allowed little time for preparation; my remarks will, therefore, be *extempore* and purely suggestive, without elaboration.

The importance of the occasion, as well as the high esteem in which I hold so learned, scientific and patriotic a body, makes me deeply regret the want of preceding special and careful study and research.

The mission of the Southern Immigration Association is to invite immigration to the fourteen Southern States. This invitation is not only extended to our less fortunate sister States of the North, but to every nation of Europe.

I will deem myself fortunate, indeed, if I can make any suggestion in aid of so benevolent an object.

It would appear that the causes of immigration being first ascertained, your labors would at once be easy and effective.

The three great essential needs present everywhere, and at all times with man, are food, raiment and shelter. That spot of earth which can furnish these with certainty and least labor, is most to be desired. Other conditions being favorable the people who have secured any part of the globe thus supplying these wants are happiest.

To these, land, labor and capital are relative terms, and the security of the first, the universality of the second, and the activity of the third, in this relation are seen, felt and admitted. History can mention no populous, prosperous country, ancient or modern, without showing the presence of the means of supplying to man food, raiment and shelter. How many of the wars of

earth have for their cause that one people coveted the advantages which another possessed in this respect? The migrations of people which have changed the face of the earth and made human history only mean a people leaving the place where these materials were not and going where they were. What is commerce but the errand-boy of these wants, and what are and have been all the great cities of the world, but spots where he for a moment laid his burden down?

Until these wants are met and satisfied no nation ever reaches that point in human progress which we term civilization and refinement. The very act of properly securing them is education, is development, is the essential training for that high, intelligent and moral culture which comports with the true dignity of man. These first, that next. Here and thus the human family attains felicity. Migration, emigration and immigration can be defined to be the need which man feels and the search which he makes for food, raiment and shelter. Therefore, the problem submitted seems not difficult of solution.

If the States which you represent possess superior means and facilities of gratifying these wants, immigration inevitably follows. It would seem, therefore, that your mission would be performed in making the fact known, and your labors may be confined to instituting the means and instrumentalities of diffusing this knowledge. You can thus anticipate, you can hasten immigration, but in this age of wonderful intercommunication between peoples and nations, these facts, if they exist, will be learned, and soon immigration will come, and as a flood.

Let us therefore contemplate the fourteen States represented in the Southern Immigration Association in the light of these wants. A glance at the map showing the Atlantic coast from Virginia, the mother of Presidents, to the peninsula of ever-blooming Florida, would cause the exclamation: "What would not ambitious Germany give for such opportunities of maritime power!" But the Southern coast ends not here, for Florida and Texas as extreme points, with other loving sisters, extend their affectionate arms and embrace the Mexican Gulf. This glance reveals a scene beautiful as a picture; but as a suggestion of human happiness it is inspiring, for in ocean and

gulf and their exhaustless tributaries there is a supply of food unfailing as their mighty floods. Not a fin parts the wave but is to be found in their liquid depths. But the waters have not finished their mission of love to man, for on their bosom and in the air is to be seen every pinion that cleaves the sky.

Of all the domestic animals useful to man, not a hoof presses the earth but can be grown to perfection in this area of fourteen States; and there is not a grass essential for provender that does not exist and flourish here.

Thus, the supply of food for man in the metes and bounds of this territory in the form of fish or flesh is inexhaustible.

But meat alone is not sufficient for the nourishment of civilized man. Then, where is the cereal of earth that does not germinate, grow and ripen here? Add to this that not an esculent need ever be absent from the table.

The first great want of man, food, is met and satisfied.

Next comes raiment, and not a fleece of animal or fiber of vegetable growth can be desired that may not be produced here. Even before the war the world recognized the fact that in a productive capacity the cotton belt of these States met no rival throughout the earth, and it became a proverb that "cotton was king," and his snowy sceptre held dominion over the peoples of the nations. Nor will my State pride let me forget the fact that at the World's Exposition at Paris, London and Vienna the fine wool from Davidson County, Tennessee, was awarded the premium. Yes, not only every fleece, but every fiber that can be grown and fashioned into fabric reaches its greatest perfection here.

Thus are we blessed with food and raiment. For the want of shelter, you have only to look at our Sylva. The vast forests proclaim the existence of all useful and ornamental woods. Besides this as the lands rise from the sea-level to the lofty eminences that skirt them, we find mountains that hold in their bosoms a wealth of architectural material that would have transported and enraptured the genius of Greece and Rome and made their proudest temples and most stately edifices bow their diminished heads in the presence of superior splendor.

So then we find all the essential wants of man most certainly and easily supplied here. Here we can feed, clothe and shelter not only our people and those of our sister States, but also the toiling millions of Europe, and in a climate so delightful as to make existence itself a luxury. Here, then, upon our broad acres and fertile lands, in our valleys and plains, in our hills and mountains, upon our rivers, streams and oceans, labor may exercise its noblest energies for the happiness of mankind; and in the assurance of large and safe returns the proverbial timidity of capital will be converted into boldness and confidence while stimulated to its highest activity.

Man might be willing to forego these opportunities and advantages if other conditions were not favorable or inviting. We will suggest such as occur to us at the moment.

Human government can enhance, mar, or destroy their value. I maintain that that people is best governed who is least governed. That permanency of government can only be secured under the rule of the majority. That a government by a minority is one of force and whose overthrow is ceaselessly threatened by the majority. In this, as in other respects, our government is fortunate. An eminent theologian, a man of profound learning and magnificent genius, attempted the interpretation of the prophecies and observing the happy effect of our government upon man's social and moral condition exclaimed: "Israel restored!"

A French philosopher and jurist after examining all the systems of government of the earth and their operation, exclaimed: "The Americans do not know that they have a government except by the blessings it confers!"

Curran stamped the impress of his oratory upon, and blended his name with the glory of Great Britain in his tribute to the "Genius of Universal Emancipation," but how perfect would have been his picture and how graphic his description had he spoken it of the United States of America. It is true nowhere else. There it was hyperbole. Ours is the only government in which the highest exercise of individual liberty is consistent with the public weal. It is at once federal and national, al-

lowing self-government and yet maintaining a national administration, a confederation of States and yet a government by all the people of the States. It is capable of indefinite expansion; nor need we indulge painful apprehensions of such expansion, for it solidifies as it expands and harmonizes as it enlarges. Under our system one vast government could be organized, in which Germany, France, Great Britain and all the other nations of Europe would become only so many States of one great confederation and the peace of the world be unbroken while controlling all the people with the same felicity as our original thirteen States.

Again, there is much in a people. The Caucasian race, the Anglo-Saxon people, are to-day the dominant powers of the earth. Witness little England, an isle of the sea, holding empire over the oceans of the world. Witness Prussia dictating policy to the trans-Atlantic nations. Witness these United States, whose humblest citizen bears the name that designates a continent and whose power preserve the peace of the western world.

Again, language is human thought vocalized. It is the history of the thought and action of a people. Our language is cosmopolitan. Like your gulf, it receives all tributaries without swelling its flood a line. As the rod of Aaron could swallow all others, so our language can engorge all the tongues of human speech and experience no sense of satiety. It Anglicizes the classic Latin and Greek, the philosophic German, the bright and sparking French, and the musical Spanish and Italian, and so complete is the assimilation that it all seems to be original English. It is the commercial and telegraphic language of the earth. The English language itself has, by growth, power and expansion become American, and Noah Webster writes the lexicon of the English-speaking people.

Thus we entreat immigration by advantages of a country rich in every blessing, a government whose only aim is the felicity of its citizens, and powerful enough to repel all aggression, and a people generous, brave and philanthropic, speaking a language which holds kinship with the world.

This very Exposition is a verification of these truths by object lessons. Your Association is therefore in exact accord and happy harmony with the Exposition. It is timely since it anticipates the effect of the causes existing. It is patriotic, because it is controlled by love of your country. It is philanthropic, for it invites brethren of less-favored States as well as the oppressed people of the globe to share the blessings which you enjoy.

ADDRESS OF A. J. McWHIRTER,

PRESIDENT SOUTHERN IMMIGRATION ASSOCIATION OF AMERICA.

We are in the midst of a great revolution. Not a revolution of the sword—thank God for peace. Not a revolution of dynamite, or nitro-glycerine, or giant powder—God pity the oppressed of the world whom tyranny has driven to such dreadful expedients. Not a revolution of government—God be praised for a Union that no political cataclysm can shake, and no partisanship can shock. The revolution of which I speak is the revolution of Industry! The world is weary of idolatries. The world is weary of dynasties. It yearns for individual comfort; it prays for universal peace. A tide of feeling is setting in upon the world, charged with grander issues than the universe of life has ever known. We have had enough of martial glory; we have had too much of martial strife. We are tired of vapid wrangling in political life, and the great industrial movement of the world here inaugurated demonstrates the opening of a new era of civilization, when economical principles shall take the place of political intrigue in the age in which we live.

There is great significance in a *Universal Exposition*, but the one which in this great center has drawn together the representative elements of the world's civilization is more important in far-reaching significance than the Sydenham Crystal Palace, Paris, Vienna—yes even than the grand Centennial in the City of Brotherly Love. They showed chiefly what *had* been done in the great fields of human industry. But this Exposition builds a platform on which the nations come for an introduction to a new commercial epoch in the history of the ages.

I cannot think that I am claiming too much for the organization over which I have the honor now to preside, if I assert that it is by this that the great purposes of industrial display are to be grandly fulfilled.

The wonderful exhibits which bewilder the eyes and daze the brains of the thousands who have flocked to the center of crystallization for the New South, all go to show that the productive possibilities of American industry are absolutely limitless, and demonstrate in a most unanswerable manner that the *deluge of supply* rises high above the *mountains of demand*. The load of national wealth is greater than the car of national progress can draw.

Nothing is the matter with this country to-day but over-production and under-consumption. We want no fewer products but we want a greater population to consume them, and it is immigration alone that can solve this problem.

Eight hundred and fifty thousand people coming in one year from the other side the sea to our country, demonstrates that the stars and stripes float over the best country to live in on which the sun of heaven shines. But let us look into this matter. Even now along the St. Lawrence and the Androscoggin, and the Penobscot, and the woods of Maine, and waters of the lake chain, the influx of population has rendered these sections as busy hives of competition as Europe can to-day exhibit. Look at the West. As an eloquent orator has lately said, while speaking upon this great question, "*There is no West.*" The emigrants have chased it across the Ohio, across the Mississippi, across the La Platte, and Fremont's exploring expedition

put their spurs into their horses' flanks and chased the West from the Rocky Mountains to the Sierra Nevadas, while the forty-niners from California, landing from their ships on the Pacific beach, took the West in the rear; and the workmen of the Union Pacific and Northern Pacific and Southern Pacific came upon it with their spades and the giant West has ceased. And though many might suppose that it might be said of it as of Moses—"No man knoweth of his sepulchre to this day," I cannot but think that the Yosemite Valley is its sarcophagus, with El Capitan for the headstone and Cathedral Rock at the foot.

The millions of foreign population that are yet to cross the sea for America will soon fill all the area between the Atlantic and the Pacific beaches. Gentlemen, no change of national administration can correct the trouble which this question of immigration has brought into the political economy of the United States. No President, though he combined the patriotism of a Washington, and the broad views of a Jefferson, and the suavity of a Madison, and the courage of an Andrew Jackson, and the old-fashioned honesty of an Abraham Lincoln, could regulate the inexorable law of supply and demand. Nor can any tariff laws, however wisely constructed from a theoretical standpoint, correct this trouble. You may put up the tariff as high as Mount Mitchell, and while you might keep out foreign goods, we have enough mills of our own left to weave ten flannel shirts where there is only one back to wear them, and ten pairs of shoes for every two feet that need them, and twenty curtains for every window that could support them, and twenty pairs of eye-glasses for all the visions that could be re-inforced by them, and twenty ear trumpets for all that could hear through them. The tariff will not cure our national malady. No, gentlemen; I am no prophet nor the son of a prophet, but I believe there is an infinite opportunity beyond, and I believe that the New Orleans Exposition will be the great settler of this great economic problem of the American future. There was wisdom, great wisdom, in the selection of New Orleans as the point on which to rest the great lever of industrial wealth. Just south of the point on which we now stand are regions nearly three times as large as the United States which are without man-

ufactures, without woollen goods, without cotton fabrics, without that superior flour which can only be manufactured from our long red-berry wheat; without agricultural implements, without telegraphs, without telephones, without electric clocks, without shoes, without sewing machines, without ten thousand other necessities of civilized life that we have and they must have. Where shall they get them? They are at present getting them from three thousand miles away, and we at the next door from them are buried under a surplus of these very things. They are able to trade with us for their sugars, and coffees, and spices, and fruits, and valuable woods, which we need as much as they need our products. But look, and then hang your heads at the statement that while our next door neighbors—the Southern Republics and Brazil and neighboring colonies—import \$675,000,000 worth of goods in a year, only \$126,000,000 are from the United States, and only a small—very small—moiety of this amount from the fourteen Southern States, of which this organization is composed. Only one-fifth of this vast trade is done with the United States. As has been wittily said by a political economist of no mean repute, European nations are taking the four fingers and leaving us the poor thumb. The sister Republics on the American continent have a foreign commerce amounting to \$428,000,000, of which we enjoy only the paltry sum of \$63,000,000.

There is nothing but a comparative ferry between New Orleans and the West Indies, while there are raging seas and long voyages between them and other continents. Yet they import \$116,000,000 worth of goods annually, and only \$31,000,000 come from us. Now, what is the philosophy of this great economical anomaly? It is just this. The Southern States of the Union have until this good day done nothing to encourage immigration, nothing to swell their population, to people their cities and their hamlets; nothing to establish the grand possibilities of the South in the great commercial avenues of the world. We want more people. We want not the scum that floats off from Northern countries—not the refuse of Castle Garden, but *the choice* of European yeomanry. Our continent is too vast for the poor immigrant to make a traveling tour of inspection to the Southern States after landing in New York.

We want an *entrepot* right here in this, the great commercial metropolis of the South, to which the eyes of the world turn so kindly to-day. And we will establish it here during this meeting if these public-spirited and big-hearted sons of Louisiana will give us their support. Will you do it?

I do not believe there is a single emigrant who seeks a happier country in homes beyond the sea could land in lovely Louisiana without feeling the charm of Southern life and the wealth of Southern clime. The facts I have presented to you are more eloquent than words. A well-regulated Southern immigration would do more to build up your commerce by land and by sea than all the tariff discussions that ever reverberated through your national dome.

Nor do we need emigration from Europe only. We have room here for the over-crowded population of Eastern and Western States. Bring population here by steamship and by railway. Build up your factories and your foundries, people and cultivate your wasting fields, stimulate the minor industries of your wonderful land, and South America and the West Indies will never let you hear the cry of over-production.

There is no relief for us in the markets of Europe, and will be none till moons shall wax and wane no more. But there is relief for us in the over-crowded population of the great world beyond the sea. Let it be sounded abroad that New Orleans, as the great radiating point of Southern immigration, can offer to the emigrant a field of labor more congenial in character, more productive in result, and more certain in fact than Castle Garden has ever held out to the coming home-seekers of the Old World, and you will see Southern trade spring into life as if by some talismanic touch.

Can I appeal to those who control our railway and steamship lines in language more forcibly than the facts which I have offered? I know that the great minds which govern the arteries of trade need nothing but facts to move them to action. I call upon them, therefore, to-day, to lend their brains, and their money, and their influence to this great work.

Like a star New Orleans sits flinging her white light across the waters that lave the shores of continents near by, that could keep active the industries of our country from the Montreal ice-palace to the halls of the Montezumas. The North is full, the East and West are full. Southward the tide of empire breaks its way.

Fill up our waste places by well-regulated emigration from far-off States and countries, and this it is which will set all the mills on the Merrimac, and the Connecticut, and the Susquehanna, and the Savannah, and the Chattahoochee running day and night, and leave no room for high tariff, or low tariff, or no tariff antagonisms, from which no practical fruit can issue.

Now is our opportunity. Europe is in turmoil and on the eve of revolution. Monarchical systems are trembling in the balance of the ages. To America the hungry and poor down-trodden look as to the Mecca of deliverance. Let us open the gates of the South and bid them enter, and let the great river, which flows from the very heart of a free country, tell here, with its mouth, the story of a nation's wealth, and sound the tidings of a nation's welcome.

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THE ORGANON OF AGRICULTURAL AND INDUSTRIAL INTERESTS IN THEIR RELATIONS TO GOVERNMENT.

AN ADDRESS DELIVERED BEFORE THE CONFERENCE OF SCIENTIFIC AGRICULTURALISTS ASSEMBLED IN WASHINGTON, D. C., JULY 9, 1885, BY HON. A. J. McWHIRTER, COMMISSIONER OF TENNESSEE.

It is a remarkable fact that the first of all sciences should in the progress of the ages have been the last systematized under developmental law. Nor at the present day, with all the facilities for progress, with all the cognate sciences pointing in the direction of its development, is the *organon* of agriculture at all fixed or positive. The General Government and the governments of the several States of our Union have come late to consider how vital to the interests of any country is the enlistment of Legislative authority in the liberal patronage of agriculture and industry. It is strange, passing strange, that for so long a time intelligent agriculture and scientific industry were left out of the councils of our land. Political pyrotechnics and diplomatic dialectics absorbed the time of our assemblies, and left no room for the great practical issues of agriculture and industry. Educated men avoided these fields of labor and rushed to the forum, the pulpit, the laboratory and the delightful Arcadian shades of literature, rather than assume the cares of agricultural and industrial life, which the educational and political systems of our land had so utterly ignored and relegated to the rude, the uncultivated and the ignorant.

It is my purpose in this paper briefly to set forth (1) the necessities of Government aid in developing agriculture and industry ; (2) the propriety of incorporating agricultural and industrial departments in our great educational system, and (3)

the importance of correlating our agricultural industrial colleges with the interests of the individuals who are engaged throughout the length and breadth of the land in these pursuits of life.

1. The necessities of governmental aid in developing agriculture and industry. There is no power in development stronger than centralization. There is no centralizing influence more powerful than government when properly administered and applied. The time has passed when every man became a law unto himself. This was barbarism, and the first dawn of civilizing influence was seen in the organizing of individuals into communities for individual comfort and the general good. In the progress of civilization it was found necessary to enlarge the scope of government from a mere system of defense into an agency of development, to divide the economical needs of the community into departments whose heads should form part of the organic unity of government, and by whose representative power such needs should be met with properly devised means of supply, and thus reach the highest end of political compact. How grandly this has been carried out in the civilization which succeeded the disintegrating system of feudalism, history most brilliantly sets forth. But it was reserved for the political economists of the nineteenth century, and that, too, of its latter half, and, I feel proud to affirm, in our own great Union, to properly appreciate the immense needs of a fuller representation of agricultural and industrial interests in the departments of government. It pains me to assert *en passant* that their efforts have too often been met with cold indifference, with sarcastic criticism, and even bitter opposition, at the hands of those in whose interests their labors were expressed. Such opposition is the offspring of ignorance, and calls for the very measures which it is my purpose to show belong to the executive authority of the land to establish.

While it is a recognized fact that individual enterprise is a great factor in the history of the world's development, it must be admitted that general progress founded upon this alone would necessarily be irregular and spasmodic. The world is fast coming to the conclusion that that government is best ad-

ministered which looks more to the development of its resources than to the establishment of its martial glory or its diplomatic renown. The amount spent for naval repairs would, if applied to the development of agriculture and industry, have made our deserts blossom as the rose and have filled our waste places with the hum of industry and the joyous song of the contented laborer. To our glory be it said, however, that without costly armaments, without martial display, the United States of America could command at a moment's notice a grander army from her yeomanry than all the powers of Europe could gather from her uniformed puppets and her armed automatons. This fact the Government should ever keep in mind, for in every appropriation for agricultural and industrial pursuits it is sustaining an army of laborers, not of idlers, who in peace are developing the internal resources of the land, and in war will spring at the throat of any foe who threatens the homes they love so well and for which they have lived and labored. Every encouragement to effort, every facility for improvement should be given by the General Government to all departments of agriculture and industry, for there is nothing that so endears an administration to the hearts of the people as a pronounced interest in the resources of every section. Superior to all party prejudice is the prosperity of every interest to which the labors of the people are committed. It is then meet, right, and the bounden duty of the Government to enlarge to the fullest extent of its capacity the means of developing its agricultural and industrial resources, and no astute diplomacy or splendid oratory can atone for its neglect.

2. The propriety of incorporating agricultural departments in our great educational system. It is only of late years that we have felt the necessity of teaching men to be farmers and artisans and mechanics. The college was held formerly as the exclusive right of the *spirituelle bibliophagi*, whose face "all sicklied o'er with the pale cast of thought," could only turn to "musty tomes on crowded shelves." But thanks to the vivifying influence of American practicality the pale student of the classics and the mathematics have been placed side by side with the ruddy sunbrowned son of toil and have felt the healthful thrill of his genial nature. The educational system of no State

is complete until her agricultural and industrial interests are represented thoroughly and effectively in her university. The State agricultural and industrial college should be the great center of crystalization for all the information that is from time to time developed in the sciences pertaining to these grand departments of political economy. It should also be the center from which should radiate all information thus acquired into the remotest corners of the State which sustains it. In this way the theoretical and the practical will be brought together in harmony, discoveries would be recorded and enlarged upon, and the investigator and the laborer brought *en rapport* with each other and made to feel a reactionary influence which must of necessity be healthful to general development.

No amount of pure scientific learning can make a successful farmer; no amount of practical experience on the other hand can supply the place of scientific culture in departments which are so thoroughly dependent upon scientific investigation. It is the harmonious union of these alone by which we can reach perfection of development. What is to be the link which binds them? This brings us to the third division of the subject before us.

3. The importance of correlating our agricultural and industrial colleges with the interests of the individuals who are engaged throughout the length and breadth of the land in these pursuits of life. How is this to be accomplished? I answer, by our State agricultural boards and bureaus. These fill up this great want in our political economy. They are the great reservoirs of agricultural and industrial information for the people. They are tangible. They come in direct contact with the people, and by correlating, classifying, and arranging these gathered materials they furnish to the college an ever-increasing museum upon which scientific methods may directly be brought to bear. It is wonderful how thoroughly filled with a desire for emulation a people will become when the result of their labors is displayed before them, carefully considered, and utilized in the direction of wider improvement. They will listen to science through a practical medium like this, and the wave of feeling that oscillates between scientific investigation

and practical experience is kept in constant activity. The agricultural archives of a State from year to year give you the panorama of its progress. We cannot do without them. A State that attempts it paralyzes its industry and writes Ichabod upon the altar of its economic wealth.

I have thus defined as briefly as possible what I conceive to be the *organon* of our agricultural and industrial interests in their relations to government, and I call upon our great leaders to lend their highest energies and talents to this vital element of national power.

PROCEEDINGS
OF THE
IMMIGRATION CONVENTION
OF THE
Northern Citizens of Tennessee,
HELD AT
KNOXVILLE, MAY 4, 1886.

PROCEEDINGS.

The Convention was called to order by Dr. Masters, President of the Knoxville Northern Citizens' Immigration Association, and Rev. Dr. Humes was called upon to open the proceedings with prayer. The reverend Doctor, whose face and form are so familiar to the people not only of our city but to this section of our State, made an earnest appeal to God, in whom we live, move and have our being—who has watched over us in times past—and who has promised to care for those who call upon Him in the future—who has permitted us to inherit the goodly land in which we live, and give us the privileges which we enjoy of good government, of the benefits of the institutions of learning, and religious privileges, to help us by His spirit to feel the responsibilities resting upon us, and to arise to a sense of our duty that will cause us to live in righteousness and peace; to give to the people a spirit of brotherly love, that would know no North, no South, no East, no West, but that the people of this great country, from the lakes to the gulf, from the Atlantic to the Pacific, of all classes, cultivate a spirit of good will, of fairness, of justice, between man and man—employers and employes—and that disorder and strife should cease and the spirit of righteousness and peace should more and more abound, and that both those who profess to know and serve Him, and those who are not professors, may give thanks for His goodness and mercies towards us as a people, closing with an earnest desire that God's spirit would prevail, not only upon the deliberations of this Convention, but throughout the whole length and breadth of this fair land of ours.

The address of welcome, by Mr. S. G. Heiskell, President of the Board of Enterprise of Knoxville, was delivered in such manner as to cause those who were present to feel that every sentence and word uttered came from the heart.

Mr. Heiskell spoke substantially as follows :

More than a century ago, there was formed on the banks of the Watauga River, in the county of Carter, a settlement which is historic in the annals of Tennessee. Those settlers came from the Old North State. Bold and hardy pioneers, they dared face the perils of the wilderness, and the cunning of the savage red man, to explore that boundless, unknown land that lay west of the great Appalachian system of mountains. Their little settlement, despite its untold hazards and dangers, grew and flourished. It was blessed by the leadership of Sevier and by the matchless courage of Tipton, and finally planted the ensign of its powers upon the hills of the Cumberland River, and founded the capital city of Nashville, and then upon the Chickasaw bluffs planted the seeds of the present splendid city of Memphis.

From this origin, gentlemen, sprang the Commonwealth of Tennessee. She knocked at the door of the American Union and was admitted in the year 1796. She came bright and glorious and splendid, and was the sixteenth star upon the proud folds of the American flag, the sixteenth sister in the royal sisterhood of free American States. Her sons are as true and brave as ever followed a drum-tap to battle and to death, or fell devoted upon the field of carnage and of blood. They followed the victorious banner of Jackson at the battle of Horse-Shoe, they hurled back the British invader at the stern contest of New Orleans, and the arid plains of Mexico drank their freely flowing blood and then, when the dark and sombre clouds of inter-sectional war hung over our fair land, they went forth to do battle, each for what he thought to be right, and fought like brave and true men. With this glorious history, with all our hopes of the future, I know you will pardon the pride, when I say that Tennesseans love every mountain of their State, every hill and every valley, and every sparkling stream that makes warbling music down the mountain side. Raised amid their own native hills, they were born to be great and free. The Switzer stands upon the summit of the proud and snow-clad Alps and looks down upon the beautiful valleys of his own native land, for which his fathers fought and bled and died, and

sees the lake of Geneva and the softly-flowing Rhone, and he then proudly reflects :

"This is my own, my native land."

The son of East Tennessee views, with prophetic pride, Nature's own gifts to his section and to his State, and reflects that in the bosoms of his mountains lie hidden that boundless wealth that will develop here the manufacturing center of the world.

To this State, gentlemen, to this section, to Knoxville, the Queen City of the mountains of East Tennessee, it has been made my more than pleasing duty to bid you welcome. Born beneath a Southern sky, the people of Tennessee, brave and true and free, tell me bid you welcome. And to you, gentlemen, from North Carolina, what words can I say? The sons of the proud old mother, the children of the beautiful daughter now greet you. North Carolina and Tennessee—the Old North State, and the State of Volunteers, their history is intertwined in a chapter of national glory, as immortal as history itself. We are glad you are here. You came from mountains and valleys like our own. Your blood flows in our veins, and we welcome you as kindred and friends. The dark days of revolution and danger have connected us by ties even stronger than those of blood, and which will sever only with the disruption of American States, which will never be.

At the conclusion of Mr. Heiskell's remarks Dr. Masters delivered an address. The Doctor has, during the time he has been in our State, had an opportunity of testing for himself the genuineness of the feeling toward men from other sections and was well fitted to respond, which he did, as follows :

PRESIDENT'S ADDRESS.

MR. CHAIRMAN AND FELLOW-CITIZENS OF THE NEW SOUTH : We are assembled to-day under peculiar though gratifying circumstances. The old proverb has lost its time-honored prestige. For the meeting of a Northern Citizens' Immigration Association, in a Southern city, is, we believe, something new under the sun. The character of this meeting is highly significant of

the progressive times and the new era which so recently has dawned upon this portion of our Commonwealth. How gloriously the general peace, prosperity and happiness which characterize East Tennessee to-day, contrast with those turbulent times of twenty-three years ago. Then neighbor was arrayed against neighbor. Contending foes met upon fields of battle, and amid the clash of arms and thunder of artillery men gave up their lives in support of opposing principles. Then death, at the hands of unrelenting vengeance, was the reward of independent speech and difference of opinion. But out of this chaos society has risen, Phoenix-like, a patriotism and an American fellowship of sublime grandeur. The wonderful and rapid evolution from this State of devastation, of confusion, of strife and recklessness, that beggars description, to a condition of prosperity, restored confidence, friendship and reconciliation, has no parallel in the annals of history. The immediate disbanding of armies and joyous return to the peaceful avocations of life, exhibit a heroism more gallant, more illustrious, than the valor of the greatest hero in war. This magnanimity of spirit commands the admiration of the world. And the heart of every native-born citizen is thrilled with the thought that this love for peace and devotion to country is purely American.

Gentlemen of Northern birth, you have listened with intense interest to the fervent and eloquent words of welcome, inviting you to homes upon Southern soil, where is extended to all the right-hand of fellowship; where unrestricted liberty, political and social, is granted, not in honor of ancestry nor in homage to wealth, but to every one according to his inherent, moral, intellectual and industrial worth. These expressions of friendship, national in spirit, coming as they do from a representative gentleman, whose birthplace and home is the South, are a happy refutation of the belief yet entertained in some portions of the country that there exists a feeling of animosity toward Northern people. Such magnanimous statements should forever dispel those lingering delusions and reassure the most skeptical upon this subject. As an adopted citizen of the State, we desire to add our testimony as to the sincerity and truthful-

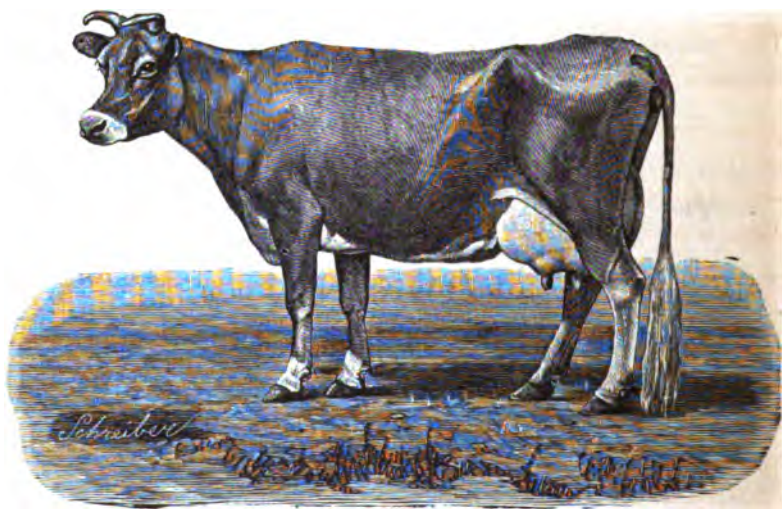
ness of those words of welcome, and that they voice the sentiments of the people of this section. Nowhere upon God's footstool are strangers more heartily received than in this liberty-loving East Tennessee. To-day, upon the very spot where battles raged, we are permitted to live in peace and security, and enjoy the blessings of a society as intelligent, refined and Christian as graces the earth.

The organization under whose auspices this Convention is assembled, has but a brief history. But we predict for it an extensive and effectual future. In January last a large number of our citizens of both Northern and Southern nativity met in Board of Enterprise Hall for a general discussion of questions, involving the material, social and educational interests of East Tennessee. After a full and free interchange of opinions, the feeling prevailed that a permanent society should be organized that would afford means and channel through which might be disseminated throughout the North and West information concerning the resources of our delightful country, and that would enlist the harmonious co-operation of our people in a movement that is of mutual interest and welfare to all. The objects of the Northern Citizens' Association, as set forth in its constitution, are the encouragement of substantial, energetic immigration to our State that will promote the growth of our cities, develop our country, aid in the establishment of a more efficient system of schools throughout the rural districts, to foster a more kindly feeling between the people of the North and South, and to bury forever beyond the possibility of resurrection the last vestige of malice engendered by the war. The motives of the association are pure and cosmopolitan. It is as devoid of sectionalism and politics as the crystal springs which gush forth in countless numbers from our evergreen hills and majestic mountains are free from poison. An organization or individual that cannot or will not ignore sectional lines and suppress former prejudices for the good of the people are barriers to progress and enemies to our common country. The expressions "up North," "down South" and "befo' the wa'" should be relegated to an obsolete past tense. The publication of inflammatory articles either North or South, calculated to

irritate or arouse the bitterness of other years, merits the contempt and should receive the rebuke of every honorable citizen. We are assembled to-day, regardless of nativity, seeking by harmonious efforts to promulgate intelligence concerning the vast latent resources which nature has so bountifully bestowed upon this country, that capital may become active and labor energized in bringing forth from their hiding-places the hidden treasures which everywhere surround us.

The numerous and peculiar advantages of East Tennessee need but to be known to be appreciated. The inexhaustible deposits of iron and coal, with immense forests of valuable timber lying in such close proximity, make this the natural center for the growth of stupenduous manufacturing enterprise. Adjacent to those incalculable stores of minerals are the fertile valleys of Tennessee, capable of producing in abundance the largest range of crops. These beautiful valleys form an excellent agricultural country, which, with its mild and salubrious climate, is not the least inviting of the many attractions of this section. Where else can be found a land abounding in such various resources and offering inducements to so many as this? Too little is known abroad of our vast stores of wealth that remain locked up in Nature's warehouse only awaiting the power of capital and the magic power of the skilled hand of man to burst forth in splendor and gladden the heart with their bountiful riches. If this Convention, by its earnest efforts, shall divulge these secrets to the world, an impetus will be given the tide of immigration to our section that will multiply our industries, increase our traffic, enlarge our cities and enhance the general prosperity of our country. We are engaged in a laudable work. Let us push forward with zeal commensurate with its dignity and importance. May the gospel of enterprise and industry be universally taught, that the people may be baptized into salvation by the sweat of their brow, and that the "light bread of life" may be broken at their tables; may the day soon come when the dog and gun shall be displaced by bleating flocks and stately herds. Then will this magnificent country blossom as the rose and flow with milk and honey.

The impression that the South is an old and worn out region has taken such deep root that it is impossible to change it,



PHLOX (16899).

Test, 21 lbs. 11 oz. Sire Guy Mannering (698); dam, Gazania (4513).

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except by time, and the wide diffusion of such evidence as its own record gives. Old in years it may be, but in development it is about the youngest among all the divisions of our grand national domain. Of the more than 490,000,000 acres lying south of Mason and Dixon's line, but a comparatively small part has ever been cultivated. It is a territory rich in the accumulated natural wealth of ages. To the capitalist and the pioneer it affords attractions and opportunities that they will find nowhere else.

The surpassing progress of the South must be a surprise even to herself.

Now, let us look at the figures. Since 1880 she has added over 10,500 miles to her railroad system, the construction of which, added to investments in old roads and their improvements, foots up nearly \$575,000,000.

Her cotton mills have increased from 180 to 353, almost 100 per cent., and in spindles and looms the per cent. is almost the same. In 1880 cotton-seed oil mills numbered forty. Now 146, with a capital of nearly \$11,000,000, or more than three times the amount five years ago.

In 1880 the South made 397,301 tons of pig-iron, and in 1884, 677,599 tons; a gain of 260,298 tons in four years. Coal, phosphate rock, and other mineral productions have developed in almost equal ratio.

Now turn to agriculture. The corn crop has increased from 334,000,000 bushels in 1879, to 489,000,000 bushels in 1885, a gain of 165,000,000 bushels. Oats have doubled in production, and the same is practically true of tobacco, fruits, vegetables, grasses, etc.

In 1880, the live stock of the South was worth \$439,900,000. At present its value is \$599,000,000, or a gain of \$159,000,000. So that, taking a general resume of the increments of interest in the South, we find that she produced, in 1885, \$300,700,000 more of agricultural, manufacturing and mining products than in 1880, and is now enjoying the full momentum of the splendid impulse that she has acquired. This is a little more than

the average value of the cotton crop, and \$25,000,000 more than the total value of the wheat crop of the whole country for the past year. During 1885, the amount of capital, including capital stock of incorporated companies represented by the new mining and manufacturing enterprises at the South, and the enlargement of plants and rebuilding of mills destroyed by fire, aggregated nearly \$67,000,000.

Now all this has been the result of sectional intercourse—the outcome of sectional strife. The North has taught the South the true philosophy of industrial economy, and by her example of thrift and energy she has marked out a new career for the South of colossal grandeur, in which both sections will sustain a mutual interest, and from which reap together the glorious fruits cemented by common interests, and consecrated by a sacrifice more awful than the world has ever known before.

Never in the history of the world has a nation had spread out before it a prospect so grand. And upon the face of the globe to-day there is not a people but the American people who could live independently of the outside world. With our vast areas, with the great manufacturing interests of the North, the boundless grain fields of the West, the inexhaustible mineral and agricultural wealth of the South, there is no limit to American development, economical or political.

When in future years our children shall see the ingenuity of the North amalgamated with the industry of the South, and Northern machinery moving Southern mills, the house of the Southern planter side by side with that of the Northern manufacturer, then, and not till then let the epitaph of the Southern Confederacy be written. We shall then see how the hand of destiny has guided us through all those stormy days into the haven of national prosperity and perfect peace.

HON. O. P. TEMPLE.

The address of Hon. O. P. Temple on the subject, "The People of East Tennessee," was listened to with great interest by those who were present. The honorable gentleman spoke of his subject as being a fruitful and grand theme. He regretted

that the subject had not been allotted to some one else who would come before his audience better prepared, as what he would say would be extemporaneous. Those who heard the Judge's address upon this occasion from beginning to end would certainly have been disappointed had any other than himself handled the subject, being himself to the manner born. His family having lived in the South for over 120 years, and Tennessee 100, his familiarity with the history of the origin of those who prided themselves on being Tennesseans eminently fitted him for the task.

In order to know their history it was necessary to go back for two or three centuries, to the days of the reign of the Stuarts, when the district of Ulster, in Ireland, and other districts were nearly filled with Protestants from Scotland and England, that had fled there so that they might be enabled to escape from religious persecutions, and although there was constant conflict, severe conflicts, yet they adhered strictly to their religious beliefs. These Scotch-Irish could not longer endure the hardships and trials there and we find them casting their eyes toward some other spot that they might make their homes and enjoy their religious liberty. So that we find in 1629-1630 from these single provinces 12,000 coming to the province of America. They came to what became to be the United States, seeking that freedom taught by John Knox, until there was from 500,000 to 800,000 settled in New Jersey, Delaware, Pennsylvania, Virginia and North Carolina.

Judge Temple gave us from the history of our country the history of the settlement of these people in North Carolina, the prominent parts taken by the men of Mecklenburg County who were made up entirely of these Scotch-Irish. His description of the battle of King's Mountain, the men who participated, the character of their peculiarities, their adherence to principle and their faith in God. The history of the first settlement of our State, on Watauga and Nolachucky, coming down through time. The part taken in the Revolutionary war, war with Mexico and even the late war was enough to convince any one that the people of Tennessee were men who believed in principle, believed in right and justice.

[We regret that we cannot do justice to the Judge's remarks, as nothing short of his own manuscript would enable us to do so.]

At the close of Judge Temple's address the Convention adjourned to meet at 2 o'clock.

AFTERNOON SESSION.

At 2 o'clock the Convention was called to order, President Masters in the chair. Gen. J. T. Wilder, who was the next speaker on the programme, not being present the

MANUFACTURERS AND TRADE OF KNOXVILLE

was ably handled by Col. T. H. Heald.

Mr. Heald spoke of the beautiful natural location of Knoxville and the many advantages which had so long lain dormant waiting the inevitable march of progress which has at last taken a firm hold on the city and the surrounding country.

Let us take a period of twenty years over which to measure the growth and prosperity of Knoxville in her manufacturing and trade interests.

In retrospection we see the somber clouds of '65 out of which the city had come, and, pardon us for a few moments if we institute a comparison with a Northern city of the same size, beginning and running through the same period. They, too, had seen dark clouds over the horizon of the South, and heard the distant rumbling, but no storm burst over their streets, though the heavens hung dark with sorrow, and messages that came thick and fast were not messages of joy, but out of this they came heavy with wealth and with staff and sandal equipped for the highway of peace. Not so with Knoxville. Platoons had wheeled into line, cavalry had moved in close column, artillery had crowned these hills with a wreath of flame, and to ashes and destruction had gone nearly half the city. Her people scattered, her banks closed, her warehouses empty, and in many of her homes Marshal Neil's had fallen.

To-day she stands, the Valley City 30,000 strong. Back in those cloudy months, a brigadier commander who had seen hard service in East Tennessee, returned to his Western home and resumed his calling in civil life. But there often comes to him thoughts of this valley and its people who had won his admiration by bravery and devotion to their cause as they contended with him, inch by inch, along the highways and rivers. One day, after toil, he reposed, and in dream thought he had returned to this New South. He saw locomotives made at Patterson, cars made at Wilmington, railroad iron made at Pittsburg, car wheels made in Boston, iron and nails made in Ohio, engines and boilers made in Erie, harness made in Pennsylvania, furniture from Baltimore, stoves from Albany, iron pipe marked St. Louis, wagons from South Bend. buggies from Cincinnati, plows from Indiana, threshers and mowers from Chicago, door knobs and locks from New Haven, household goods from Boston, carpets from Lowell, jeans from Kentucky, cotton goods from Lawrence—all this, and much more. He thought he had returned and was striving to push back this tide of importation. He saw wide excavations, from which iron ore was being lifted; he saw mountains pierced, and from their sides came trains of coal, drawn by Tennessee locomotives, on Tennessee cars, and over Tennessee steel rails. He saw a railway start from Cincinnati, costing millions, till it reached Chattanooga. He saw another from Louisville to Knoxville, another from Knoxville to Charleston. He saw the East Tennessee & Virginia Railroad from Bristol to Knoxville stretching out its mighty arms until 1,500 miles measured its track. He saw two cities in the valley, little cities, one a mule corral, the other a corral for mules. He saw them in a friendly race, with an open track before them; now one was 9,000, then the other 10,000; now one was 14,000, then the other 15,000; then one was 19,000 and the other 20,000; then one was 30,000 and the other was 30,000, and neck and neck they passed out of sight, having just turned the first quarter post, and as a shout of progress went up he awoke.

Knoxville now produces: Iron and nails, \$500,000; woolen goods, \$140,000; leather, \$100,000; fine furniture, \$120,000; zinc spelter, \$100,000; sash, doors and blinds, \$100,000; foundry

and machine works, \$150,000; marble and coal, \$1,000,000; groceries, \$2,000,000; boots, shoes and hats, \$1,000,000; hardware, \$800,000; clothing, \$600,000; harness and saddlery, \$300,000; books and stationery \$100,000; queensware, \$200,000; cars and car wheels, \$400,000; cotton goods, \$125,000; common furniture, \$75,000; wagons and buggies, \$25,000; stationary engines and boilers, \$200,000, ax and hammer handles, \$50,000; timber and lumber, \$800,000; dry goods, \$1,500,000; hardware, \$800,000; drugs and paints, \$400,000; stoves and tinware, \$25,000; agricultural implements, \$300,000; candy, \$50,000. Total, \$11,285,000. Business under \$50,000 not included.

Twenty years ago nearly every dollar of insurance in this city was sent North, but now a Knoxville company insures in part the estates of A. T. Stewart, H. B. Claffin & Co., and Lord & Taylor, of New York, and Marshall Field, of Chicago. We sell iron and nails as far West as Topeka, Kas., and in every Southern State but one. We sell woolen goods from the Knoxville Woolen Mills in Philadelphia and Chicago. We sell ax and hammer-handles in nearly every State in the Union, and in the larger cities of South America and Australia. The manufacturing interests mentioned above need no further comment than the figures affixed, as showing their products—they must go somewhere.

Col. John J. Craig published a statement six years ago that in the near future Knox County would be shipping three times as much marble as they were then shipping, and his predictions have come more than true. They now ship ten times as much.

The jobbing trade of Knoxville is a monument of courage, ability and integrity, backed by ample accumulated capital. With heavy stocks and massive warehouses, they push out in every direction, challenging all comers and competing successfully with jobbers in any city in the Union. * * *

We have plenty of room for more. We want iron furnaces, stove foundries, chair factories, and a thousand things in a smaller way. Come; you can trust your material interests and your homes among people who, for twenty years, have strewn

flowers and builded monuments over their dead. Come; nor distrust the applause of Montgomery or the floral-paved streets of Atlanta. A people has done honor and stood uncovered in the presence of an aged ex-chieftain who, for more than twenty years, has not commanded a soldier or held power of the lowest office. Could they do less and belong to the Brotherhood of Americans? If they worshiped in Gerazim, did we not worship at Jerusalem? But the hour cometh, and now is, when we shall all be given a new national life, welling up within us into eternal love of country.

But I trespass upon your time. Once more, let me say to our Northern and Western friends, come to Knoxville. You shall find her churches and her morals and her public schools, which are the bright gems in her crown of glory. You will not find much blue or gray; these colors have long since mingled in brighter colors of hope. Come among us, and in the near future you shall see Knoxville forty, fifty, and one hundred thousand inhabitants, and finally be one among the prosperous cities of a new empire which will conquer its way with arms of iron and coal, with supplies of forest and stream, with sinews of marble and mineral, with fortress of mountain climate, until the mists of '65 have all rolled away, and the dawn of universal prosperity shall spread over a united, progressive, noble, Christian people.

General Wilder having made his appearance, was called upon and gave the Convention a full and complete description of

OUR MINERALS AND TIMBER.

If there is any subject that the General is conversant with it is this—in fact, we hardly believe that he would feel at home on any other subject, unless it were on Chattanooga or Cloudland. The opportunities of the General for finding out facts in reference to the minerals and timber of our State have been more, probably, than any other citizen of our State, having during the war and since then, ridden to almost every place, not only East Tennessee, but Southwest Virginia, North Carolina, Georgia and Alabama, where there was any hope of finding min-

erals. The discoveries made during the war so thoroughly impressed him that as soon as he possibly could, he made haste to come to our midst, and to his efforts Tennessee is indebted in a great degree for the fame our minerals have received in other sections of not only this country, but abroad. He gave a glowing account of the future of our State; with the natural advantages and facilities it possesses, he saw no reason why the citizens of East Tennessee, if they would awake to a sense of their duty, study more to their own interest, doing less tobacco-chewing, drinking and spending their time in questions pertaining to politics, should not be as prosperous as any in the whole country. He saw no reason why Knoxville (so favored by nature, situation, nearness to coal and ores) should not be a large manufacturing center, and all that was needed to make her a city of 100,000, in a short time, was for her citizens to do their part in fostering manufacturing establishments, by supporting them, patronizing them, investing in them. He described Chattanooga directly after the war, and her extraordinary steady advance since then, coming from a small, insignificant town to a city of large proportions, and pointed with pride to her as an example that Knoxville would do well to follow.

The General's remarks were well received and elicited from time to time such approval that we feel confident that he has awakened our people to a sense of their duty—to arouse from their lethargy—and take hold with increased efforts and make our city what she ought to be—a manufacturing center. Our report of the General's practical talk is so incomplete that we must, in closing, say that to appreciate what he says in reference to this subject, it must be heard from his own lips.

THE COMMERCIAL RELATIONS OF WESTERN NORTH CAROLINA AND EAST TENNESSEE

were presented by Mr. C. J. C. Deake, of Asheville, N. C., in a very able manner. He said that the relations were so close, politically, socially and in a sense of commerce that it is difficult to tell where one begins and the other leaves off. He gave a glowing description of the many superior industrial and com-

mercial advantages of both sections, and particularly of his own immediate section with which he is so intimately acquainted and identified. He alluded to the Northern Settlers' Association of Asheville, organized with similar purposes of those governing the Northern Citizens' Immigration Association of Knoxville, and said that the organization had been effected for the purpose of attracting Northern people to this region. He spoke of the boundless wealth of timber, minerals, etc., awaiting development at the hands of the energetic, pushing capitalists of the North, and that every dollar spent in East Tennessee benefited Western North Carolina and East Tennessee alike. The paper read by Mr. Deake is a very lengthy one and treats of every subject which could possibly be of interest to the people of the North.

Hon. A. J. McWhirter, Commissioner of Agriculture, Statistics and Mines, upon the subject of

THE NORTH AND THE SOUTH,

spoke as follows :

In the history of every people there have ever been sectional interests and sectional difference. Variety of industry has ever engendered the struggle for supremacy and the rivalry of power.

Political economy recognizes this as the fundamental principle of civilization and the great stimulus to national development. But in no country have the lines of industrial interest been so clearly drawn as in the United States of America.

Before our great civil strife, which shook the universe from turret to foundation stone, the agricultural interest of the South and the industrial interests of the North had developed, under the existing economy, a clash of power which could only be adjusted by an appeal to arms.

The manufacturing interests of the North—vast in proportion, varied in character, and almost boundless in revenue—appealed to the laborers of the world with a directness which concentrated their allegiance and focalized their efforts to develop the sectional power, about which their own prosperity had crystallized. On the other hand, the almost feudal system of the

South had developed an aristocracy of landed interest into which no labor competition could enter, and which no labor system could overthrow. At that time there was no strikes in the South—that is, among the laboring classes; the striking was on the other side in those days.

Here then, we had, throughout the length and breadth of our vast country, the strangest industrial organism which political economy has ever known. On the side of the North, immense capital and diversified labor to support it. On the side of the South, a landed oligarchy, sustained by slavery, and independent of labor from without, for agriculture was the sole idea of Southern economy—the *articulum startis vel cadentis populi*.

The abolition of the “peculiar institution” not only brought about political revolution, but it altered the whole industrial economy of the land.

Three millions of people, who for generations had known no other pursuit than that of agriculture, and who at that time were believed to be alone physically capable of conducting successfully that branch of it which formed the genius of the South, were thrown out upon the world to choose their own pursuits and shape their own industrial career. From that moment the industrial economy of the North and that of the South were placed upon an equal footing—theoretically, but not practically—for generation after generation in the North had rendered her people familiar with diversified industry; while at one blow the South was left to solve the problem of her future with but one industrial factor—the produce of her lands. Who can wonder at her economic failure under such a blow? The sudden paralysis of her then single industry, the overthrow of her time-honored customs, and the disruption of her inherited social relations, who could prophesy for her aught else but anarchy and ruin? Oh, my friends, also those of us who passed through that fiery ordeal can ever know the matchless miracle of her resurrection from the ashes of her desolation, for truly, “out of the eater came forth meat; out of the strong came forth sweetness.” But the problem has been solved, and that which seemed her ruin has been made the basis of her future glory.

In the North, over-production has become the great danger to her industrial economy; in the South, it was over-consumption, and only by such a cataclysm as that which swept over our land could the industrial balance of our country ever have been established.

Up to the time of the great struggle, the Southern people had relied entirely upon the North for their manufactured goods, and the North, satisfied with such a market for her wares, had been content to stand aloof from all that made up Southern economy; and the South, on her part, resting upon her bulwark of slavery and trusting to her snow-white fields for all she was or ever hoped to be, never so much as looked with interest upon Northern economy or encouraged the introduction of Northern industry within her borders. But times have changed and we have changed with them. To-day the streams of agriculture and industry are commingling. The introduction of Northern capital and Northern industry into the South has paved the way to her future glory.

Heretofore the advantage has been at the North and with the North. She had costly plants before the South ever dreamed of being anything but an agricultural region; she had skilled labor and capital at her command.

The South had rich fields and a glorious climate, but was content to stop when she had produced the raw material. But the day of utter dependency has past, and the era of co-operative interest has been ushered in with splendid enthusiasm. The looms have already commenced to move in the cotton fields—but as yet only the advanced guard. A little while longer and there will be legions. A splendid start has been made. Under the magic of machinery the Southern States are taking a new lease of life and the Star of Empire which once looked Westward is resting over the South to-day, shining steadfastly on the fairest land the Creator ever fashioned, inhabited by a prosperous, powerful and progressive people, redeemed from ruin by the magic touch of industry now spreading throughout her borders. What a marvelous story of development is that told by the figures gathered by the *Manufacturers' Record*, of Baltimore. It is a story of established pros-

perity and assured advancement, and we are glad to hear from no less authorities than the *Philadelphia Times*, the *New Orleans Times-Democrat* and the *Boston Post*. I regret that the time allotted me will not permit of lengthy quotations of encouragement which have from time to time appeared in all of the leading journals; suffice it with the following words from the *Boston Post* to our people, which go so very far towards healing the wounds of fraternal strife in the dark days of our Republic:

“It cannot but be gratifying to the Southern people, and is calculated to direct the course of capital and the tide of emigration from all parts of this country and even from England to that now truly favored part of the Republic.”

At the close of the afternoon session Col. Dickenson, with his usual spirit of hospitality, invited all the delegates and others present, including the ladies, to spend a social hour after the adjournment of the night's meeting at his residence, which was, on motion, received and accepted without a dissenting voice.

NIGHT SESSION.

The night session was also well attended and the subjects ably handled. When we consider the questions discussed and the gentlemen discussing them, it could not be otherwise.

THE GROWTH AND OUTLOOK OF CHATTANOOGA

was handled by Col. J. E. MacGowan, editor of the *Chattanooga Times*. Colonel MacGowan knows all about Chattanooga, and that is a great deal to know. He gave a complete history of the foundation, growth and marvelous progress of his adopted city. The paper included everything that could be said in the way of statistics, facts, argument, etc.

CREAMERIES

was the title of an able and interesting paper read by Hon. Stanley H. Bell, of Nashville.

At the conclusion of Mr. Bell's address he moved the adoption of the following resolution, which, after being amended by suggestion of a delegate from North Carolina, so as to request of the North Carolina delegation in Congress the same action as that asked of the Tennessee delegation, was unanimously adopted:

Resolved, That it is the sense of this Convention that justice to the dairy interest of the Nation, and especially to this rapidly-growing industry in Tennessee, demands such legislation from the General Government as will prevent its threatened destruction in some sections and injury in all, by reason of the illegitimate traffic in what is known as oleomargarine, or imitation butter, and to this end would request our Senators and Congressmen from Tennessee to support what is known as the Scott Bill, as it has been favorably reported from the House Committee on Agriculture.

CONVENTION NOTES.

It is a splendid beginning, and next spring the number of people in attendance will be doubled.

Mr. Samuel G. Heiskell, President of the Board of Enterprise, deserves credit for the interest he has shown in the workings of the Convention.

Several Chattanoogaans who had never visited Knoxville were surprised to find a city of such imposing pretensions, and they all wondered how this can be thus.

During the intermission at noon a large number of delegates were driven by private conveyance to Island Home. Colonel Dickinson chaperoned the party in person and took pains to show them through the premises.

Arranged in front of the speaker's stand were quite a number of the products of the soil and specimens of manganese, iron ore, zinc and marble, thus practically illustrating the fact of their existence to the satisfaction of all present who might otherwise think the picture overdrawn.

RECEPTION AT COLONEL DICKINSON'S.

After the adjournment of the Convention quite a number of our citizens accompanied the members of the Convention to the residence of our fellow-townsmen, Col. Perez Dickinson, on Main street, in response to the kind invitation extended to all members and their friends. The grounds were illuminated by gas jets, forming an arch. There were three arches, which made the grounds appear like a fairy-land. The gathering was quite large, and after a bountiful supply of refreshments and social chat good-byes and congratulations were exchanged and all retired to their resting places. The visiting gentlemen members of the Convention were well pleased and the citizens once more under obligations to Mr. Dickinson for the neat manner in which he treated those who are the guests of our city. Crouch's band turned out in full and enlivened the occasion by some of their choicest selections.

 CHATTANOOGA.

AN ADDRESS DELIVERED BY COL. J. E. MACGOWAN, EDITOR OF
THE TIMES.

MR. PRESIDENT, GENTLEMEN OF THE ASSOCIATION, AND LADIES: Chattanooga is located in longitude 85 degrees and 20 seconds west from Greenwich and beneath the thirty-fifth parallel, north latitude. It is nine degrees nearer the equator than the famous region, "the South of France," three degrees nearer than Southern Italy, one degree nearer than the extreme south limit of Spain, and two degrees southward of the Island of Sicily. It is in the same latitude with Central Arkansas, Lower Virginia, Northern Texas and Southern California.

THE PECULIAR DENT OR COVE

in the Cumberland Mountains in which the city lies is surrounded on the north by Walden's Ridge, on the east by Mis-

sionary Ridge, on the south by Lookout Mountain, and on the west by Raccoon Mountain. This basin is of an average extent north and south, east and west, of about eight miles, "as the crow flies." It is dotted over with hills and small depressions, is washed by the Tennessee River, the channel of which bounds the city on the north and west, and winds through the cove in a most wonderful and picturesque way. Surveyed from the top of any of the surrounding mountains, the space I have described looks like a tract of fairy-land, upon which a great ribbon of silver had been carelessly uncoiled. Beheld from one of these heights at this season, when spring has on her brightest robes, or seen through the clear sky of a November day, when frost has tinged the foliage in all colors, from the fiery red of the sour-wood to the sober dun of the white oak, the valley in which the "Mountain City" nestles is one of the loveliest prospects the human eye ever rested on.

EARLY HISTORY.

The landing now used by all river craft on the south bank of the Tennessee, reached by four principal streets of the city and well paved, was known to chance adventurers into the Cherokee country, as early as 1786, as the best landing on the river between Knoxville and the shoals. The ground is permanent; there are no bars; the channel never has shifted within the knowledge of the oldest pilot, nor according to tradition. The excellence of the spot as a landing place doubtless was a chief incentive to the establishment of a civilized settlement by John Ross, the Indian chief, in 1834, or about that year. He had a ferry and a warehouse, and the place went by the name of "Ross' Landing" for several years. In 1835 several white families settled on or near the site of Chattanooga. One of these, Samuel Williams, is still living below the city on a river bottom farm. In 1836 the town was laid out by an engineer and called Chattanooga. In 1837 a post-office was opened. Capt. John P. Long was made postmaster; he is now the oldest citizen of the city. In 1838 the inevitable printing office and newspaper appeared—the *Hamilton Gazette*, F. A. Parham, editor and proprietor. The same year a mail route was estab-

lished, by coaches from Nashville, Tenn., to Augusta, Ga., to be run tri-weekly. Up to this time the village of Rossville, out in the edge of Georgia, consisting of four or five houses, was of more importance than "the landing," and the latter was supplied with its mail from Rossville by private contract. In 1839 there was a public sale of lots. Those along the river brought good prices, some as high as \$1,600, and from that down to \$800. We may remark, parenthetically, that those values on river front lots have not very greatly increased, while lots a half mile from the river, that could not have been given away forty years ago, sell now at from \$400 to \$1,000 per front foot, a rate which would make a lot the size of those which brought \$1,600 on the river front in 1839 worth, if in the vicinity of Eighth and Ninth streets, fronting on Market, from \$4,000 to \$110,000. Real estate in the town in those early times was given mercantile value and importance almost entirely by the river trade, and none was of much account except it was near the wharf. From 1839 to 1852 the town handled all the cotton that was raised in the coves and valleys of North Georgia and all grown in the fertile valley of the river and on the rich prairies of North Alabama and Southern Tennessee. The river was then the only great commercial highway, and all the grain and cotton produced in its splendid valley and tributary coves and valleys, were marketed at Chattanooga, the only town of any importance from Kingston to Muscle Shoals, a distance of about 300 miles. In 1841 the town had grown to enough size and importance to justify incorporation and municipal organization. The frontier village prospered for eight years doing a good stroke of business as the chief distributing point for a large circuit of country round about. Great quantities of cotton were handled for those times, as well as much bacon, flour, iron, whisky and dry goods.

THE FIRST RAILROAD

to reach Chattanooga was the Western & Atlantic, built by the State of Georgia from Atlanta and finished to Chattanooga, its northern terminus, in December, 1849. That event greatly stimulated trade, especially in cotton. During the season

for handling that staple it was no uncommon sight to see Broad street stacked full of cotton bales from the river well up toward the depots, several thousand bales thus being disposed of in a single week, waiting shipment by rail to Charleston via Atlanta. The town did not grow in population in proportion to its importance as a trading post. It required comparatively few people to handle the grain and cotton and meat and textiles, and there were in those times no industries worth mentioning. The total population returned by the census of 1860 was 2,545, and 451 of those were negroes, all but a few being slaves. I find no returns for 1850, but the recollection of those who lived in the town through our sixth decade, is that the growth in population in that period was small.

MORE ROADS.

Within this ten years the East Tennessee & Georgia, the Memphis & Charleston, the Nashville & Chattanooga Railroads were built to the city and put in operation. These lines gave the city connection with the Mississippi River on the west and with the ocean on the east, and also furnished an outlet to the Cumberland and Ohio Rivers at Nashville and Louisville. Still, as I have said, the growth was slow. Trade in cotton, farm products, dry goods and negroes limited the horizon of the commercial community. There was a dim perception of the enormous latent wealth lying on every hand in the form of coal, iron ore, limestone, timber; yet there was almost literally no enterprise in developing these resources. A few of the people knew there was coal and iron ore in the hills and mountains; they all saw the magnificent forests, but cotton paid better, had less work in its production and management than a mine or furnace or saw mill or textile factory. Trade in the staple, family supplies and slaves absorbed what capital came into or was accumulated in the country. The people were a contented, jolly lot of high-spirited frontiersmen. Not until the war had brought down the meddlesome, prying, inquisitive, acquisitive thrifty Yankee, did the old inhabitants of the middle of the Tennessee valley, or, for that matter, of any other portion of the Southern mineral belt, even dream of the riches that lay in

the bosoms of their rugged ranges, and beneath their very corn-field and cotton plantations. The change in the labor system piqued inquiry and hastened development in many directions. Striking the bonds from the slave made it necessary for the cultured, once wealthy class, to seek new modes of making money. Having been deprived of that part of their capital invested in laborers, they naturally set their wits to work for means of employing free labor so as to make a profit out of it.

THE WAR WAS THE MAKING OF CHATTANOOGA,

as it was of the whole iron and coal belt of the South. Even as late as 1870 there was comparatively little known of the extent of the mineral riches of the country of which it is the commercial and industrial center. Some of the finest coal lands within a few miles of the city sold ten or eleven years ago for from 50 cents to \$2 an acre. No longer back than 1876 a few gentlemen with speculative notions in their heads thought it might be an easy thing to "corner" all the iron ore within a circuit of twenty or thirty miles and get control of the beds lying in the river valley for a hundred miles above and as many below. They soon found out, upon setting practical mineralogists to work on the preliminaries of the scheme, that it involved the purchase of a half dozen counties entire, and that speculation was abandoned. Instead of a few ledges here and there, as these amateurs supposed to be the situation, they learned that bodies of ore from one to sixty feet thick were as common almost as limestone, and nearly as easily obtained as the stone can be quarried. Nor did our people a few years ago have more than a very indefinite idea of the

SUPPLIES OF COAL

lying within fifty or sixty miles of the city. A few of the outcrops had been followed into the hillsides a short distance. It is not more than ten years since mining was done in any part of the Tennessee or Warrior fields on a large scale. In 1874 the total mined in Tennessee was 350,000 gross tons. In 1884 this had risen to 1,200,000 gross tons, and in 1886 it will reach fully 1,500,000 or more. From 1880 to the present

year the development has been at an average rate per year of 200,000 gross tons. From 1873 to 1880 the total average output was not quite 400,000 tons per year, and the development in the whole seven years was but 100,000 tons.

MANUFACTURING DEVELOPMENT.

Our coal is the basis and its use the sure indication of the amount and value of the manufactures, and our coal development from 1880, when the output stood at 600,000 tons, to 1884, when it reached 1,200,000 tons, shows conclusively that the manufacturing business in Tennessee has achieved its chief growth within the current decade. This is peculiarly true of Chattanooga and the district directly tributary to her. When the census of 1880 was completed our total capacity for making coke pig-iron was about 95,000 tons with six completed stacks. It is now 320,000 tons with twelve completed stacks. Two of these are at Chattanooga, two at Dayton, two at Rockwood, one at Oakdale, one at Rising Fawn, Ga., one at Cherokee, Ga., two at South Pittsburg, and one at Cowan. All of them are first class in respect of machinery and economical appliances of production. No equal number of furnaces in this country make better iron for all ordinary foundry and mill uses, nor do any others produce so cheaply.

THE COKE PRODUCTION

grew rapidly from 1880 to 1884, in the latter year reaching, according to the national geological returns, 219,723 net tons, an increase of nearly 100,000 tons in three years. This, I am satisfied, is at least 100,000 tons below the real product of 1884, the returns probably covering the coke that was sold and but a fraction of that consumed where made. There are now in the State 1,600 ovens against 656 in 1880, and 14 establishments making coke to 6 in 1880. The price of coke at ovens went down from \$2.42 per net ton in 1880 to \$1.95 in 1884.

These are matters of rather a general nature, but they relate directly to the past and current history of Chattanooga and her future prospects. The city is nothing if not a center of man-

ufacture, and the two supreme requisites of a great emporium of industry are cheap fuel and iron, and these Chattanooga possesses in abundance, as I have shown.

The furnaces I have mentioned all lie either in the city or within a circuit of less than ninety miles of it, the average distance being about fifty-five miles. The tendency to furnace development is to rely on the market for stock, building the plant at the city or near it, so as to take advantage of railroad competition and water transportation.

Considering the rate of growth in the pig-iron industry since 1879, we may readily believe that the Chattanooga and Birmingham districts will each smelt a million tons a year in 1890, or two-fifths the present total product of the country.

THE PRESENT YEARLY OUTPUT

of something about 200,000 gross tons of coke iron by the Chattanooga stacks, at present close prices, is worth \$3,600,000, and brings that amount of money into the district, most of it being paid out to labor. Every ton of iron smelted gives employment to ten hands directly and indirectly. Therefore the business furnishes work for 5,480 people in mines, at furnaces, in transporting supplies and products and in supervising these operations. Averaging the daily pay of this force at \$1.25, it shows the amount of daily wages paid by our iron masters is \$6,776, and the yearly, \$2,472,240. This is an enormous sum to be paid by an industry that is not yet eighteen years old—is in its infancy. These facts give a vivid idea of the strength of Chattanooga's ground as

A MANUFACTURING POINT,

and the possibilities ahead of the city in that direction.

And when I say that two rolling mills, three or four foundries and as many machine shops in the city employ 2,000 hands regularly, pay our yearly \$1,350,000 to labor and half as much more for raw materials, I give a faint indication of what the city will amount to when its pig-iron is chiefly consumed for finished products at home.

Here allow me to dwell a moment on the great importance of greater diversification of industries in the departments of railroad supplies, farmers' tools and machines, mechanical appliances, stoves, engines, water-wheels and the finer grades of castings in both iron and brass; also in wire-work, edge-tools, such as axes, scissors and all lines of household cutlery and hollow-ware. One great rail mill at the city in 1881 produced over \$2,750,000 worth of steel bars, and the same company made about \$250,000 worth of pig-iron. That mill is temporarily idle on account of a revolution in both prices and appliances for steel making, but it will not remain idle long. I mention this instance to show the enormous difference in the value of a product that is finished ready for use and the same volume of crude material, or semi-crude, such as pig-iron. One first-class stove foundry is worth as much to a community as two or three big blast furnaces, each of which cost more than the foundry. The same rule applies to a first-class mill, fitted up to make bar-iron, spikes, bolts and all the supplies used about a railroad track except the rails. Nail mills are profitable ventures to owners and the cities where located. The furnace and the manufactory must go together to insure all the benefits.

Let me put the whole argument for greater diversification toward finished articles in a few words. To work up into the various forms of wrought iron and steel the metal the Tennessee furnaces smelt would require investments in various plants and their working capital of not less than \$15,000,000, and the yearly output would sell at home, taking the lowest market price, at \$30,000,000. Not less than \$10,000,000 of this would go to skilled and ordinary labor, and would add fully 50,000 souls to the population. Does any man who has intelligently studied the growth of the city since 1879 not know that she will consume as much iron as all the furnaces in her district can now smelt, before a dozen years shall pass? It is a very moderate estimate of her probable growth to put it at this in the line of iron and steel materials, and the increased population this industry alone will attract at 50,000. That much will be compassed by 1895, unless accidents not now probable overtake the iron trade. The mills, foundries, etc., of the city now work up ten tons to four worked six years ago. The total

used now cannot be less than 160,000 tons per day and about 40,000 tons of wrought and cast scrap; but the product is of the coarser and cheaper articles of utility. Besides iron and cognate branches of industry, there are others beginning to assume great proportions, among them being

WOOD WORKING

in various forms. Within ten years the cut of lumber at the city has grown from five million feet to about thirty million, and the total handled by dealers and manufacturers will reach about sixty million. A considerable portion of this is worked up into furniture, the product of bedsteads alone being about 130,000 yearly, besides a vast number of tables, kitchen safes, and a considerable amount of higher grade furniture for dwellings and offices. Fully twenty million feet are worked by the various carpentry concerns for builders' use.

This trade probably employs about a thousand men and boys in the city, and gives work to a considerable number in the logging industry along the river and its tributaries. It will more than double in volume and importance within the current decade.

There are several other prime factors of growth not necessary here to be enumerated. It follows, of course, that the purely commercial business of the city must greatly expand in *personnel* and materials handled, as the city rapidly advances in manufacturing importance.

A COMPARISON

with a much older, and in some respects very similarly located city, may be of interest in this discussion.

The city of Cincinnati was the village of Fort Washington in 1788, the name being soon after changed to what it now is. In 1800, twelve years after its foundation, the town had but 750 inhabitants. We know the growth was very slow in the next two decades, for the census of 1820 showed a population of 9,602. Then came in the era of steam river navigation, and

Cincinnati grew to a town of 24,830 in 1830. In the next ten years the per cent. of increase was less, showing only 46,338 in 1840. From '40 to '50 the railroad era stimulated growth, steamboat business was pushed to great importance, and canals connecting the city with the great lakes were put in operation, and the population went up to 115,438 in that ten years, being an increase of more than 255 per cent. Thence on the growth has been slower, but more solid, marking 161,004 in 1860, 216,289 in 1870, and 255,139 in 1880.

Look at the history and physical advantages of Chattanooga, and both these and its growth—except as ours was destroyed, reduced to zero by the civil war—are very strikingly like those of her older and greater neighbor on the Ohio. We have some elements of prosperity Cincinnati does not possess; she has advantages in agricultural backing we have not, and never can secure. Let our coal, iron and lumber offset the Queen City's proximity to the finest general farming region in the world, and we shall about be her equal in natural resources, the raw materials from which skill and labor create wealth. In 1890 Chattanooga will be very close in population to what Cincinnati was in 1840—46,000. Cincinnati began the thirty years ended in 1840 with perhaps 5,000, or something more than Chattanooga contained at the close of the war. If the comparison holds good to the end of the century, the Mountain City will have then 115,000 to 120,000 inhabitants, and there is no reason to be found in her past growth or future prospects to make such a prediction the least unreasonable. The town is almost free from competition. There is no city drawing from her any trade, manufacturing capital or population. All she gets she holds, and the gains are in larger volume year after year. My citations of the census reports demonstrate this, and I have full confidence that our directory census enumerations are more just and full than those made for the Government.

The limits of this address being set according to a careful calculation of the patience of my audience, I shall hasten toward the close as rapidly as may be done and give myself and my topic a reasonably fair showing.

FOOD SUPPLIES.

The basis of a great manufacturing emporium, as I have remarked, is formed of plenty of good and cheap raw materials, and these Chattanooga has all about her in lavish profusion. But men must live, and life demands food for its support. Manufacturing life must have cheap food and plenty of it. Hence the question,

WHAT IS THE COST OF LIVING,

as compared with such cost at other centers? becomes a vital consideration after the supply of materials has been found and tested. In general terms, I may say Chattanooga affords as cheap living as any town of its size, growth and pretensions. Staple groceries and dry goods are as low as they are anywhere. Rents are stiff, as is the case in all rapidly-growing cities. Building is not expensive. Many of our thrifty mechanics, clerks, laborers and small tradesmen, occupy their own houses, and the tendency in that direction is greatly stimulated by our two successful savings and building associations. As to other necessities, such as meats, butter and the like, they are quite as cheap as in the Northern towns. Our local resources in corn, wheat, vegetables and fruit far exceed the local demand, leaving a liberal margin for shipment. Our grain dealers handle large quantities for the cotton-belt markets of Atlanta, Augusta, Macon, Columbus, Savannah, Selma and New Orleans. There are no more prolific corn lands in the world than the Tennessee river bottoms. In 1874 the late Hon. Tom. Crutchfield gathered an average of 112 bushels to the acre off a field of forty-three acres, and one selected acre, carefully measured by a surveyor, gave 119 bushels by weight, the same being attested by a committee of gentlemen, of which Maj. T. B. Kirby, one of the founders of the *Chattanooga Times*, was chairman. This was a choice field, and the growth was made in a very favorable season; but it shows that Tennessee bottoms, decently farmed, will certainly yield, year in and out, seventy-five bushels of corn to the acre, and there are millions of these acres tributary to Chattanooga, one-half of which have never been

tickled by plow or hoe. To go more generally into this branch of the subject, we cite the statistics of the Agricultural Bureau of the State, as to the productive capacity of the valley proper, above Muscle Shoals. In 1877 the chief products of this region were:

Wheat, bushels.....	7,099,564
Corn, bushels.....	24,179,106
Oats, bushels.....	3,889,969
Hay, tons	116,744
Cotton, bales.....	62,974

The value of live stock supported in the valley was then \$27,771,909, and the forest products were \$377,795.

To the cereals, hay and cotton, we may safely add 30 per cent. to cover the gain, and to this date, while the forest products are now fully \$3,000,000 yearly, and the value of live stock is nearer \$60,000,000 than it was \$30,000,000 ten years ago.

As for fruits, berries and truck, the surrounding country ships hundreds of thousands of dollars worth of these yearly to the Northern and Eastern markets. With our fine merchant wheat and corn mills supplied by home grain, our abundance of peaches, apples, pears and berries, ripening from the first of May until the middle of October, and lying within easy reach of the semi-tropical fruits of Southern Georgia and Florida, one can live luxuriously and cheaply in Chattanooga if he can anywhere.

Even if we were cut off in a measure from home supplies by a bad season, our railroad systems reach every point where grain is grown or other supplies produced, and the competition of the lines hold rates down to the lowest possible figure. I have been all the late winter and this spring furnishing my table with Western beef, stall-fed in Kansas, slaughtered in Kansas City and shipped in car-load lots to Chattanooga butchers. It is as fine meat as ever graced the board of a British epicure, and is sold side by side with the products of our Tennessee farms at the same price. In years of short crops we get flour from Denver and Kansas City. We ship berries and peaches to Cincin-

nati in May and June, and import these things from Cincinnati in July. But our exports of food articles far overbalance imports for local consumption. We raise a large surplus of almost everything our climate and soil are capable of, and our eight railroad lines to all points make this surplus available for foreign consumption at a profit to the producers. Besides food products the county in which Chattanooga lies grows about 1,500 bales of cotton yearly, and the adjoining counties in Tennessee and Georgia furnish nearly or quite 12,000 bales, and it is of the very highest quality of short staple upland fibre, very white and highly prized by spinners.

Now let us consider some of the more general evidences of growth in population, extending the inquiry over longer and shorter periods. The last census covers the period of peculiar depression, extending from 1873 to 1879; yet the growth was by no means below the normal. Below is a table showing the

POPULATION OF EAST TENNESSEE BY COUNTIES, 1870-1880:

<i>Counties.</i>	1870.	1880.
Anderson	8,704	10,820
Bledsoe	4,870	5,617
Blount	14,237	15,985
Bradley	11,652	12,124
Campbell	7,445	10,005
Carter	7,909	10,019
Claiborne	9,321	13,373
Cocke	12,458	14,808
Cumberland	3,461	4,538
Fentress	4,717	5,941
Grainger	12,421	12,381
Greene	21,608	23,005
Hamblen	8,500	10,187
Hamilton	17,241	23,642
Hancock	7,148	9,098
Hawkins	15,837	20,610
James	4,700	5,187
Jefferson	19,476	15,846

<i>Counties.</i>	1870.	1880.
Johnson	5,852	7,766
Knox.....	28,990	39,124
Loudon	7,500	9,148
Marion	6,841	10,910
McMinn.....	13,996	15,064
Meigs.....	4,511	7,117
Monroe	12,589	14,283
Morgan	2,969	5,156
Polk	7,869	7,269
Rhea	5,588	7,073
Roane	15,622	15,237
Sequatchie	2,335	2,565
Scott	4,054	6,021
Sevier	11,028	15,541
Sullivan	13,136	18,321
Washington.....	16,317	16,181
	<hr/>	<hr/>
	845,295	421,969

This shows an increase of 18 per cent. in the whole, while in many of the more favorably located counties it was at a much larger rate. In Knox, for instance, the census showed a growth of 33 per cent., 35 per cent. in Hamilton, 33 per cent. in Hawkins. But one river county, Roane, shows a falling off. Most of them display liberal gains.

In the absence of population and industrial statistics since 1880, and for shorter periods, we may fairly resort to the election returns. It is well established by the Federal census that the voting population of Tennessee is slightly more than a fifth of the whole, and the votes cast in Presidential years about one-sixth. I ask you to keep these facts in mind, while I cite a few figures that are both curious and suggestive.

THE THIRD CONGRESSIONAL DISTRICT,

of which Chattanooga is the commercial and industrial capital, cast, in 1880, 22,794 votes. In 1884, with one county less in the district, the vote was 28,511, or a gain of nearly 26 per

cent. in four years, at the rate of 150 per cent. in the current decade. I select Presidential years, they being certain to bring out as full a vote as is ever cast, and being therefore good gauges of the increase in population. Now, if we go back to 1876, we find this same district voting 21,850, but 1,300 less than it cast in 1880, indicating but a meager rate of growth in those four years. Every indication and fact points to the conclusion that this section of the State, and especially those portions about our centers of trade and production, acquired more population in the first four years of the decade commenced with 1880 than was achieved in the entire preceding ten years; and Chattanooga is a living witness that the increase of wealth has greatly outrun that of people.

Below is a table giving the vote of East Tennessee by counties in the two Presidential years 1872 and 1884:

<i>Counties.</i>	1872.	1884.
Anderson	1,001	2,060
Bledsoe.....	1,005	988
Blount	1,754	2,672
Bradley	1,359	2,196
Campbell	746	1,793
Carter	1,339	1,982
Claiborne	1,155	2,311
Cocke.....	1,300	2,462
Cumberland.....	366	800
Fentress	433	674
Grainger	1,229	2,143
Greene.....	2,616	4,618
Hamblen	1,241	1,947
Hamilton	2,728	6,266
Hancock.....	789	1,474
Hawkins.....	2,047	3,502
James.....	547	758
Jefferson	1,864	2,645
Johnson.....	855	1,280
Knox.....	5,089	8,729
Loudon.....	1,169	1,496

<i>Counties.</i>	1872.	1884.
Marion	790	2,008
McMinn	2,231	2,956
Meigs.....	692	1,208
Monroe.....	1,587	2,378
Morgan.....	338	907
Polk.....	835	1,237
Rhea	672	1,667
Roane	1,552	2,628
Sequatchie	249	426
Scott	368	999
Sevier	1,214	2,709
Sullivan.....	2,222	3,474
Washington	2,395	4,374
	<hr/> 43,677	<hr/> 79,462

This is an increase of nearly 80 per cent. in twelve years. But we must remember that the vote of 1872 was cast too close to the final social and political reconstruction of the State to make it of much value as an indication of population. The increase in some of the more favored counties was remarkable. Hamilton's vote went from 2,728 in 1872 to 6,266 in 1884, or 130 per cent. Knox County made a gain of 70 per cent., Scott made nearly 300 per cent. None of the counties show a loss, while some of the river and railroad localities did wonders.

Now to show by contrast how great a portion of this swelling of population took place in the last third of the period our last table covers, I give the vote of East Tennessee by counties in the Presidential years 1880-1884:

<i>Counties.</i>	1880.	1884.
Anderson	1,632	2,060
Bledsoe.....	867	988
Blount.....	2,470	2,672
Bradley	1,738	2,196
Campbell	1,352	1,793
Carter	2,049	1,982
Claiborne.....	2,179	2,311

<i>Counties.</i>	1880.	1884.
Cocke	2,514	2,462
Cumberland.....	678	800
Fentress	825	674
Grainger.....	2,102	2,143
Greene.....	4,504	4,618
Hamblen.....	1,945	1,947
Hamilton.....	4,162	6,266
Hancock.....	1,441	1,474
Hawkins.	3,586	3,502
James	626	758
Jefferson.....	2,536	2,645
Johnson.....	1,295	1,280
Knox.....	7,436	8,729
Loudon.....	1,554	1,496
Marion	1,646	2,008
McMinn	2,672	2,956
Meigs.....	1,002	1,203
Monroe.....	2,102	2,378
Morgan.....	779	907
Polk.....	1,020	1,263
Rhea	1,095	1,237
Roane	2,438	2,628
Sequatchie.....	345	427
Scott.....	709	999
Sevier.....	2,483	2,709
Sullivan.....	3,471	3,474
Washington.....	3,680	4,374
	<hr/> 70,952	<hr/> 79,462

The total increase was, in round figures, 9,000 votes, or 13 per cent. But the bulk of this gain was made in comparatively few of the counties, and they the ones that had means of transportation and have encouraged manufactures. Fentress, Grainger and several others either positively lose voting strength or show almost no gain at all. Hamilton registers a bound of more than 50 per cent. in her returns, while Knox made 14 per cent. Scott, Morgan, Rhea, Marion and other

counties, stimulated by manufacturing and railroad development, did nearly as well as Hamilton.

And now, gentlemen, I show the advantages a district which diversifies its industries by the introduction of manufacturing on a liberal scale has over one devoting its people's energies chiefly to barter and agriculture, I will compare

THE VOTE OF THE SECOND AND THIRD CONGRESSIONAL DISTRICTS

in the two Presidential years, 1880 and 1884:

The vote of the Second district, all of which is tributary to Knoxville, in 1880, was 26,859; in 1884 it was 28,350. The total gain in votes was 1,491; the per cent. of gain $5\frac{1}{2}$.

The vote of the Third district, the river and railroad section of which is tributary to Chattanooga, was, in 1880, 22,794; in 1884 it was 23,511. The total gain in votes was, for the four years, 5,717; the per cent. of gain 25 and a fraction.

The indicated increase in population in the Second district in this four years is 11,946.

The indicated increase in the Third district for the same period, is 34,302.

A very large portion of this increase occurred in the two leading counties of the two districts—Knox in the Second, and Hamilton in the Third.

The indicated increase in Knox, calculated on her vote in these two test years, was 7,758 souls.

The increase for the same period in Hamilton was 12,624.

The per cent. of gain in Knox in these four years was $26\frac{1}{2}$.

The per cent. of gain in Hamilton in the same period was 73.

These, gentlemen, are not "invidious comparisons," nor made with any view save to lay before you the inexorable facts of current industrial and vital history in Tennessee, especially in this section. I am trying to show how intimately the growth of human vitality is interlaced with that of diversified industry. It were boyish folly or the impertinence of conceited senility to allege that lower East Tennessee has made her extraordinary

strides of development because that section is more favored in soil, climate and natural elements of wealth generally, than are either the Middle or Eastern district. The greater growth of the country down the river has been brought about by the accidental or providential turning of that people's attention to the manufacture of iron and the working of the crude metal into mercantile forms. The circumstance that General Wilder located the first coke furnace ever built in the South so as to make of it a Chattanooga furnace, was the initial point where our prosperity began. In the eighteen years since that little stack was lit up there has been a constant tendency of capital toward investment in like schemes in our district and in the city itself, until the furnaces and furnace estates now represent fully \$12,000,000, saying nothing of their commercial capital. These plants and the mills, founderies, machine shops and related industries they have caused to spring up, tell the story. The 12,000 and more inhabitants the county of Hamilton gained in the four first years of the passing decade were made up chiefly of immigrants who settled in Chattanooga, and at least 90 per cent. of them are active producers, workers. The addition of several thousand laborers and artisans to the forces employed in our manufactories calls for additional mercantile capital to supply them food and raiment. They must have houses and furniture, all the various wants of men and women and children are to be furnished them, and the demand thus created builds up smaller manufactories and broadens the market for farm products. Our great leading line of iron making has literally forced the ramification of our industries into several channels, and the diversification has only begun. Not until at least 1,000 different articles are made in the city and its suburbs, will the restless and venturesome spirit of our people be content with their achievements. And in this connection I may properly allude to a most important event in our iron business; to-wit, the successful test of

A CHATTANOOGA BESSEMER STEEL PLANT,

April 20th, the material used for the purpose being Cranberry iron, smelted from ores mined in Mitchell County, North Caro-

lina. The product was in all respects perfectly satisfactory. It sets at rest the question "Has the South a Bessemer steel ore in large quantity?" It makes Chattanooga the pioneer Southern steel maker of Southern materials, and foreshadows an indefinite number of enterprises to spring up there and at other Southern points that have been held in abeyance by the fact that our iron so far has lacked this, the most valuable and rapidly becoming the indispensable form, Bessemer steel. Much capital will come among us now that would not come before this experiment proved successful. I have full faith that it will hasten the reopening of the great Roane rail mill, with its 600 operatives, and a product worth in its yard not less than \$3,000,000 a year.

It has long been known to a few that a like experiment with this iron made by a Philadelphia establishment was successful. Chemists have always rated it as a Bessemer ore. But the average iron master of Pennsylvania and Ohio said to all these showings: "It is of first importance to the symmetrical development of the Southern iron trade, that it have a reliable body of Bessemer materials. If you have that, the way to convince the world of the fact, and at the same moment give your section a big boom, is to show your faith by building an experimental steel plant and fully testing the Cranberry as a Bessemer iron." That has finally been done, and the doing at once demonstrates that Chattanooga can compete with and beat all comers in her home market in steel nails, railroad bars and a score of other articles now made of steel.

THE PIONEER

who has put it beyond cavil that we have a fine steel ore is the South Tredegar Iron Company, which was also the pioneer Southern mill in making steel nails from Northern-rolled Bessemer nail plate. Mr. J. M. Duncan, the Vice-President and Manager of the company, has had large experience in steel. He grew up in the great iron and steel works of the North, South and West, and to his practical foresight, knowledge and courage the manufacturing interests of Chattanooga and the

South owe the coming of this important factor to their aid now, instead of its being delayed several years.

While Mr. Duncan was building his converter Captain Chamberlain, President of the Roane Iron Company, has been busy upon a most important experiment with Cranberry ores, in the success of which the most experienced iron and steel masters have full confidence; it being nothing less than smelting a large lot of iron with coke fuel from that ore, and fully testing it as Bessemer material in a Northern converter and mill. On the issue of this project will depend the starting of the rail mill, and I have no doubt as to a favorable report.

These specific activities, these reachings out for means to match the North and the world in this season of narrow profits to manufacturers, is a manifestation of the undaunted, unstampedable spirit which has made Chattanooga the city she has grown to from a hamlet of white-washed shanties in twenty years.

Now, gentlemen, a few words on the moral, social and vital features of my topic and I shall not further tax your patience, and first as to

THE SCHOOLS OF CHATTANOOGA.

The present system of graded schools was organized in 1873. The total school property then owned by the city was a one-story frame house on Georgia avenue, containing three rooms and worth, with the lot on which it stood, perhaps \$3,000. The city in 1886 owns six large buildings, containing sixty-six rooms for study and recitation, worth under the hammer of the auctioneer \$80,000, and all paid for.

In 1873 the enrollment was 1,097 pupils. In 1885 it was 3,458, an increase of 215 per cent. in twelve years.

In 1873 the scholastic census was 1,419. In 1885 it was 5,058, a gain of nearly 500 per cent. in twelve years. The annual gain now and for the last five years has been at an average rate of about 550 in the enumeration of pupils of school age.

In addition to our popular system the city is the site of a University of the Methodist Episcopal Church, the main building of which, at a cost of nearly \$100,000 with the ground, approaches completion, and the several schools pertaining to the literary and scientific departments will be opened in the approaching fall.

A young man or woman graduating at our excellent high school, free of all cost for tuition, has a most substantial foundation upon which to begin the practical affairs of life. If the young man or woman desire the finishing touches in science, literature, law, medicine, theology, he or she may be accommodated without incurring the expense of going from home.

TAXATION

for all county and State purposes has averaged \$1 on the \$100 valuation. The duplicate showed a total property value in the county of \$5,500,000 in 1880, which rose to an even \$10,000,000 in 1885. The rate for the city is one and seven-tenths per cent. on the valuation, or a total for all purposes on city property, of say two and seven-tenths per cent., which will be about the average for several years to come.

The county owns a court-house and jail, both paid for without issuing a bond, that cost \$104,000, and about \$60,000 worth of macadam road and iron bridges also paid for. The public buildings are among the best and handsomest in the South.

The city is not provided with suitable public buildings, and has no finished streets, though all the principal streets will be permanently sidewalked with brick or stone by the end of the current year. The total bonded debt of the city is \$180,000, with a sinking fund in hand of \$20,000, bringing the debt down to \$160,000. The sinking fund is rapidly increasing.

Money to loan commands 8 and 10 per cent.

The banking capital is \$750,000, and the banks, three in number, are among the staunchest in the country.

The city is a favorite loan market for capitalists in the surrounding counties.

CHURCHES.

There are a dozen or more churches owned by white congregations, and as many more by colored people. I estimate the aggregate value of our church property at \$250,000. They cover every denomination, there being two Baptist, three Presbyterian, one Catholic, three or four Methodist, one Episcopal and a mission chapel of that sect, one Cumberland Presbyterian, one Christian or Campbellite, one Jewish Synagogue. The church edifices cost from a few hundreds up to \$30,000. The colored Baptists are building a house that will cost, with the lot, \$20,000 to \$25,000. The Christians have just finished a handsome brick church, costing \$10,000. The Episcopalians will build a temple this summer, to cost \$40,000 to \$45,000. The churches are not in debt to any considerable amount, most of them being entirely paid for when finished.

HEALTH.

Chattanooga's death rate is about twenty-one per thousand per annum on the average. The rate for whites is less than fifteen per thousand; that for the colored is about twenty-nine per thousand. We have a great many settlers from the North, who come to the city on account of threatened lung trouble, or to mitigate catarrh, asthma or some other chronic disease. These partially invalided new comers and the notorious ignorance of health laws, and recklessness of the penalties for violating them, of the colored people, make our death rate about 50 per cent. higher than it would otherwise be.

DRAWBACKS.

It has occurred to me while I have been reading that several of my auditors were asking themselves, "Wonder if he's going to say anything about Chattanooga's wonderful water privi-

leges and other picturesque if not solid advantages of a similar character?" Ah, gentlemen, I had no idea of dodging one of the chief attractions of my most attractive subject. It don't come often, but it does sometimes come too high for the comfort of our dwellers on low ground.

Yes, gentlemen, we have had floods galore and been plagued by epidemics just like other cities located on great waterways and at centers of transportation and travel, where any vagabond with any affliction from *cacaothes* to cholera is liable to land and distribute contagion before the health authorities can find him out and isolate him.

In neither of these are we singular, as contrasted with other cities on navigable waterways. Cincinnati suffered more loss in 1884 than Chattanooga *could* suffer if all her low grounds were to be studded with mercantile and manufacturing establishments and her experience of 1867 were then repeated. Boston and its suburbs had 160,000 people turned out of their houses by flood last winter, and Montreal has but now taken a bath of ice water. All the towns and cities of the central South, as well as the farms along the streams, suffered more or less in the last March and April.

The fact remains that we have on the two sides of our magnificent river land above any flood of record save Noah's, sufficient to build a city of a half million people, and we have now means and pluck enough to put such low grounds about our water front above high tides, as may be desirable.

**THERE MUST BE A GREAT CITY ON THE GENERAL SITE INDICATED
BY THE NUCLEUS NOW KNOWN AS CHATTANOOGA!**

That has been definitely settled by the experience of the last seventeen years. The facts here recited, gathered from the census tables and election returns, and the further solid fact that there is now in various stages of completion a half million dollars worth of business and manufacturing structures in Chattanooga—these leave no room for quibbling on that point.

The town has passed through its infantile municipal setbacks such as pertain to all childhood. We have had our corporate measles, mumps, chicken-pox and even an occasional attack of *water brash*, but the babe has grown to a lusty young manhood in spite of it all, and is stronger for having been tried in the furnace of adversity and affliction. The evanescent misfortunes pertaining to location have also great advantages that cannot be found apart from the power of permanent water transport, in holding down freight rates. The fact that Chattanooga is the terminus of eight great trunk lines of railway makes her peculiarly liable to be caught by even local epidemics. No city in all England had the plague very seriously in 1665 except her great commercial metropolis, London.

Over against all her drawbacks, Chattanooga writes and points to her 117 per cent. growth in population from 1870 to 1880; to the doubling of her tax assessment from 1880 to 1885; to the expansion of her wholesale trade to many times double its value when the last census was returned; to the increase of manufacturing capital from \$2,600,000 to more than \$5,500,000 in the last six years; to a thousand palpable proofs of prosperity to be seen by the most casual and careless observer.

And at last, gentlemen, it must be recognized that Chattanooga is but the outward sign of the inward powers of development in our magnificently beautiful region, with its infinitely varied soils, climate, minerals and timbers; this lovely land on the border of the cotton of the South and dividing it from the boundless corn and wheat fields of the North and Northwest.

I have devoted so much time to essentials I can say very little of detail. Chattanooga has an elaborate system of water works; two gas companies—gas at \$1 per 1,000 cubic feet—six miles of street railway, and four more miles projected; two large flouring mills; a paid fire department fitted up with two steam fire engines, full supply of hose; a fire alarm telegraph will be put in this year.

These and many other accessories of city life are supplied, and a good many more are needed to make the city a finished

place. In fact, at the present rate of change and growth, the time appears to be far distant when Chattanooga will be in any sense a complete municipality, with nothing to be desired, with no feature her restless, inventive, enterprising people will not wish to change for the sake of improving it in merit or style.

REPORT OF PROCEEDINGS
OF THE
EAST TENNESSEE
FARMERS' CONVENTION
HELD AT
KNOXVILLE, MAY, 1886.

PROCEEDINGS.

The Eleventh Annual Session of the East Tennessee Farmers' Convention convened in the Federal Court-room, in Knoxville, on Tuesday, May 18, and continued in active session for two days. The attendance was quite large, composed of representative farmers from many of the counties of East Tennessee, many of whom are accustomed to anticipate these annual meetings with enthusiastic interest. The good resultant it is impossible to estimate. The proceedings are uniformly courteous, able and interesting, and through these conventions of practical farmers many associations and attachments have been made that are most endearing.

President Meek called the Convention to order at 10 A. M., and the proceedings were opened by Rev. C. B. Lord, of Blount County, with the following

PRAYER:

Almighty and eternal God, our Father in heaven, we render Thee devout thanksgiving and praise, that we, Thy servants, are permitted to meet this morning in our annual convention.

Thou art the source of all our blessings; from Thee cometh every good and perfect gift, life, health and strength, to meet the daily labor of our lives. Made in Thine image, Thou hast placed us under responsibilities of no little moment. This earth is Thine, for Thou didst make it; Thy hand piled up these mountains, spread abroad these valleys, and traced the courses of our rivers; Thy hand also guides the forces of nature, so that seed time and harvest, summer and winter, visit us in their order, year by year. Thy word sends the sun, day by day, and the winds of heaven and the falling showers to bless the earth. All this, and more, that is above and beyond the strength

of our hands proceeds from Thee, that life and its blessings may abide upon the earth. To our hands Thou hast committed the tilling of the soil. We are Thy servants, and by our hands, under Thy blessing, the earth is made to produce food by handful for the wants of man and beast. Give us wisdom, we pray, in all the work of our hands, so that plenty may abound in our land, and to-day may Thy blessing rest upon all our deliberations. Taking counsel, one with another, may light be given, showing us the best methods for causing the earth to bring forth more, and still more abundantly the means for sustaining human life. And to Thy name, O God, the Father, Son and Holy Ghost, will we give the praise evermore. Amen.

Judge Temple, of Knoxville, welcomed the Convention to the hospitalities of the city. Knoxville was ever glad to have these meetings within her gates, and recognized the eminent worth and gentility of the members.

President Meek accepted these courtesies on behalf of the Convention, and was glad of an opportunity to renew acquaintances long since begun, and so pleasantly year by year continued. President Meek delivered his opening address, as follows:

GENTLEMEN OF THE EAST TENNESSEE FARMERS' CONVENTION:
We are met in this, the Eleventh Annual Convention, to take counsel together. It is a meet and fit occasion upon which to acknowledge the beneficent Providence that has during the past year protected our homes from the scourge of pestilence and the destroying cyclone and preserved our industrial interests from the dangers and losses growing out of the strikes of organized labor unions.

May we not also congratulate ourselves that this Farmers' Convention, by its manly and dignified discussion of practical questions, has won the esteem and confidence of all classes to such an extent as that its meetings are looked to annually as indicating the progress our people are making in the intelligent culture of their farms. Let it be impressed upon our minds that there is no surer sign of progress and enterprise among any people than to see farmers awake to the importance of at-

taining improved methods in the cultivation of their lands, and in restoring and retaining their fertility. We may point to thousands of farms in East Tennessee whose fields and crops give proof of the success of systematic and intensive culture.

Though there be other thousands lacking in these desirable environments, it has been the constant effort in the meetings of this body to establish and cultivate among farmers such a spirit of pride and emulation as would drive them to the attainment of better information and methods in the cultivation of their farms. This has been the first and primary of the discussions in this annual meeting of farmers.

There is another and higher object yet to be attained. It is to free ourselves from the thralldom of partisan politics and co-operate upon all questions affecting the most important of all industries—agriculture.

All measures tending to the protection and encouragement of the agricultural interests of the country should receive our united and intelligent support, without reference to the kind of politics involved.

The homes of a people are the springs whence emanate that spirit of patriotism, enterprise and pride of country, that makes a people great. And around a home should grow and cluster all the virtues and graces that make life desirable and worth the living. Therefore all questions in any way relating to the educational and material interests of the farmers are legitimate and proper subjects of discussion in this body. Not in a factional or class spirit, but from a broad and liberal standpoint which comprehends in its scope all the interdependent interests of all classes and industries. No country is made great and prosperous by one single industry.

These desirable conditions are attained in the highest degree where all the industries of civilization are founded and built up in close proximity to each other and the material used in the productions of such industries.

Farmers, may this spirit characterize, as it has heretofore, all your deliberations and discussions, and as a result may farming as an avocation be rendered more attractive and made one of

honor and dignity. In this direction lies our work, and it is worthy our best efforts. We have here a country of which to be proud in many respects. But it has susceptibilities and possibilities of which we have hardly dreamed, and which, when attained, will make it one of the most desirable on the continent. We may not look back into the past; it is gone.

The future is ours in which to retrieve the mistakes made and improve the opportunities it may offer.

It lies before us big with the promise of grand possibilities, which, if observed and cultivated, will prove a boon to ourselves and our children, and, when realized, will be the wonder and pride of those coming after us. Be it then our work to hasten this desired result. We shall bless the land of our birth and honor will crown the work we bequeath to posterity, and the spirit of peace and liberty will smile upon us from the azure heights of our mountains, and the horn of plenty will be turned into the laps of our people.

No people may, with impunity, ignore advantages and opportunities placed in their reach by the concurrent forces and handiwork of Nature, and she has been lavish in her gifts to us as to climate, scenery and mineral wealth. A new era has dawned upon us and invites us to renewed diligence and public spirit. In this new era hope stands upon expectant foot, and pointing with eager hand, bids us forward upon new fields of industry in a wide domain of promising possibilities.

Reports of the various committees being next on programme, Col. C. W. Charlton, Chairman Committee on Immigration, made a brief verbal statement of the status of the question. Numbers of Northern people were continually in our midst prospecting with a view to a home in East Tennessee. They find many encouraging features in the way of a splendid climate, a hospitable people, a country with many elements of prosperity and plenty, but with sensibilities disturbed by the many evidences of neglect and carelessness on the part of our farmers who neglect to grow enough grass. After some discussion as to the business of these standing committees, and they not being fully prepared to report, the matter was passed until they could prepare reports.

Mr. P. L. Detrick, of Bellfontaine, Ohio, testified as to the great value of these reports. Northern people esteem them very highly, for they should give just the kind of information they seek. Producers want to know where they are to find markets for their crops and of the manufacturing energy and facilities of the people or country.

President Meek agreed with Mr. Detrick, and was glad he had spoken.

Judge O. P. Temple, on behalf of the University of Tennessee, extended an invitation from that institution for a committee to visit and inspect its workings.

Mr. J. J. Burnett, of Cocke, J. A. Turley, of McMinn, Geo. O. Cate, of James, Geo. W. Folsom, of Hamblen, and J. G. Hall, of Anderson, were named as the committee.

The business of the programme for the forenoon having been exhausted, on motion Rev. C. B. Lord, of Blount, was asked, and did favor the Convention, with the following sensible and timely address:

ADDRESS BY REV. C. B. LORD.

MR. CHAIRMAN AND GENTLEMEN OF THE CONVENTION: We hear a great deal said just now about the grasses. "We want our hills and vales clothed with the grasses," says an enthusiastic gentleman, lately from the dairy regions of the North, and to all this I most cordially respond, amen.

Our hill-sides, worn and wasted, gaping with gullies, and staring at us, "in the face of Israel and the sun;" our sedge fields waving in the wind, and the old fields given over to the pines should, instead, be clothed with carpets of grasses, beautiful to the eye and helpful to the purse. How can we accomplish this? Talking never so much of beautiful hill-sides, covered with green pastures will not remove the ghastly unsightliness of the red gullies, fringed with sedge and dotted with pines, that now so often greet the eye in our otherwise beautiful valley of Tennessee. We must bring a more potent force into the field. Money is an eloquent argument—it appeals to all classes, it touches the springs of action, and is a mighty persuader in

all human affairs. Let it be shown that there is money in grass—that these hill-sides and sedge fields now so unsightly and profitless can be made sources of large revenue when clothed with cultivated grasses. Let this conviction become firm and general, and then the disappearance of all this ghastly unsightliness is only a question of time. The old pine fields, the red grinning hill-side exposures, and the unsightly fields of broom-sedge will be transformed to hill and dale clothed with green pastures and waving meadows; and our loved East Tennessee will become the very garden of content. To this “high argument” I now address myself, Mr. Chairman, and beg the patient attention of the Convention to the statements I now submit.

Two distinct methods of farming prevail. One makes the raising of grain the chief object, the other the raising of stock, sheep, cattle, horses, etc. Under suitable conditions both are profitable, as conditions vary one becomes more profitable than the other, and in many, perhaps in most, conditions a mixed husbandry is the most profitable, the proportion that one should bear to the other being determined by the circumstances in the case. Our East Tennessee, with its hills and mountains, its frequent valleys and rolling uplands—a land of laughing brooks and bubbling springs, beyond any other that the world knows, was evidently intended by Providence to be a grazing country. Our frequent and heavy rains washing and wasting the hill-sides that are under the plow, show that grass—a good sod—is needed both to prevent and to remedy the ruin they cause.

If the conditions of a country render grazing farming a necessity, we might infer that, under a kind Providence, it would also be profitable. Believing that grazing farming is profitable in all its different branches, I will now, however, speak chiefly of one—*i. e.*, Dairying, and only incidentally, if at all, of the others.

Butter and cheese have been staple articles of food in all civilized lands, and will continue to be while the world stands. A good article will always command a fair price. For the last forty years dairying has taken the lead in the agricultural interests of the North and East; not that it has supplanted other interests, but it has more than kept pace with them in remu-

nerating the farmer for his labors. The following data will help you to form an intelligent opinion as to the profits of the dairy business: A gallon of milk will make a pound of cheese, and three gallons of ordinary milk will make a pound of butter. Experiments made with the milk of Jersey cows show that a pound of butter has been made from seven quarts; but the Jersey breed of cattle stands without a peer in the richness of the milk given by its cows. Taking the above statement as approximately correct, and supposing a good cow to give an average of two gallons a day for three hundred days, we have six hundred gallons as the year's product of a single cow in milk, and it is also the equivalent of six hundred pounds of cheese, or of two hundred pounds of butter. The product in cheese at the low price of ten cents a pound, would be sixty dollars, or in butter, at thirty cents a pound, would be the same.

Good butter has been quoted in the New York market the past spring from twenty-five to thirty-two cents a pound. Many families in our Southern cities pay thirty cents a pound for butter the year round. But butter, we must admit, fluctuates in price in our Southern markets. Put the average price at fifteen cents a pound, and the product of a cow as above would be thirty dollars a year from the butter sold; add to this the profit of the buttermilk fed to calves or hogs, as the case may be; add also the value of the manure applied to crops growing on the farm, and call the value of both items ten dollars, and you have forty dollars paid you by each cow you keep.

Notice in the above statement, first, the quantity of milk on which the above calculation is based—two gallons a day, or four quarts to a milking—good cows, well fed will beat this; and second, the low price of butter supposed, when the farmers of East Tennessee get to making a good article of firkin butter they will get New York prices, *minus* some two cents for commission and freight.

Again, it will be noticed that at the relative prices of butter and cheese there is more money in cheese than in butter. Butter can be made, and well made, from a single cow, but to make cheese it requires a number of cows, and whenever cows be-

come sufficiently numerous cheese factories and creameries will be established, taking the milk from the hands of the farmer and giving it the direction that will pay the best.

At present such establishments are next to impossible, because there are not cows enough to sustain them. Admitting that, when they are introduced, the profits of dairying will be largely increased. What I wish to do now is to show that there is money in cows as things now are, and so aid in stimulating this industry until the number of cows shall be so increased as to authorize the introduction of factories for working up our milk.

In the estimate given above I put the annual quantity of milk quite below what a good cow should yield, and at a price quite below the average price of cheese for the last ten years; the sales in cheese would be sixty dollars, and in butter from thirty to sixty. I have met farmers in this section whose sales from their cows run from fifty to seventy dollars a year, and I have known dairymen in the North whose sales amounted to from ninety to a hundred dollars for each cow they kept. Take the low estimate of forty dollars as the proceeds of a cow for a year, and suppose that ten cows may be kept to every hundred acres under improvement. Four hundred dollars is the result. How many of our farmers make cash sales of four hundred dollars from one hundred, or from each hundred acres of land not in timber. Does some one ask can the cows be kept on that amount of land? In Western New York I have kept seventy cows on something more than three hundred acres of improved land, and in this State I have kept and am keeping the equivalent of thirty head of cattle on an improvement of one hundred and forty acres—and further, let a farmer with two hundred acres of improvement keep twenty cows and save their manure with care; in five years he will raise more grain with the cows on the place than he is now raising without them. In feeding cattle for the market a farmer who this spring purchased steers two and three years old for from fifteen to twenty-five dollars; runs them in pasture this summer and next fall and winter stall-feeds them, will think he does well if he can get from forty to fifty dollars for them in the winter or

spring following. The result of the year's growth and feeding is a gain of twenty-five dollars. But the lowest estimate made above, for a dairy cow, is forty dollars, for the same time, and from that stretching up towards a hundred. I believe it is conceded that the farmers who feed good cattle are among the most prosperous of their class, and when we have a class of dairymen who will make not simply twenty-five dollars or thereabouts for a year's care and feeding of an animal, but from forty to seventy, and in some cases a hundred dollars, will not we see a prosperity to which we are now strangers?

And when we have learned that grass farming is the surest and quickest way to wealth, then will our hills and valleys be covered with carpets of green, hiding the nakedness that now shames us, and making our East Tennessee the most beautiful part of the continent on which we dwell.

Thanks were voted Mr. Lord for his address.

[It may be proper to say that Mr. Lord is of the celebrated family of that name in New York. He came to East Tennessee immediately after the war, and has done much to build up our section.]

Dr. Gillespie, of Knox—If you want to sell your farm and attract buyers, get grass upon it. We can restore and make productive farms by proper effort.

AFTERNOON SESSION.

"Shall we Encourage the Cultivation of Tobacco?" was opened by Mr. D. W. Remine, of Greene County, in the absence of R. M. Alexander. The time has come when farmers must change from the old-time farming of wheat and corn to something different, and as an immediate money crop nothing promises better rewards than a well-grown and properly handled crop of tobacco, and for the money there is in it, the farmer can well afford to venture into it in a small way at first, and to extend his crop as experience justifies. It is ex-

haustive on land, but farmers in this era of low prices look for a crop that will pay, or promises to pay, best. We should not rush into the cultivation of tobacco blindly at first.

Colonel Meek, of Jefferson County, was decidedly opposed to the cultivation of tobacco. No one could be benefited by its use. It is a question of how long we who use it will live, and this consideration should influence the farmer in all he grows and offers for sale. It is a curse to man and land; 99 out of 100 people who die at a premature age die, more or less, from the intemperate use of tobacco. From a personal experience of more than thirty years he could testify to the absolute control and positive injury it had on him, and it would have killed him had he not relinquished it. For every dollar it puts into the grower's pocket, one thousand is taken in the way of wasted energy and depleted brain from slaves to its use. I would not encourage its growth under any consideration. It is not the way to make good farms or domestic happiness. There are too many other ways to prosper. Don't fool away your time with tobacco. Better let sedge-grass grow. Substitute grass and the better classes of stock and you make more and better money, and better farms.

Dr. Gillespie—Colonel Meek is a little like the boy the calf ran over. Because one boy got run over is no reason every other boy should be run over. I know men who make money raising tobacco. My grandfather was 88 years old, a persistent tobacco user, and one of the most healthy of men. Men are naturally of different constitutions.

J. J. Burnett, of Cocke—Would not discuss the moral part; he was against it on that score. He read about tobacco, and wanted all the information he could get on that subject. He had lost \$300 or \$400 on one crop. There is at least 2,500 acres of tobacco cultivated in his county, and probably twenty-five out of twenty-six men lose money on it. But good methods and good handling would undoubtedly give a handsome profit.

Mr. Lord, of Blount—Hill land, when rich, makes fine tobacco. But it will wash as badly after a tobacco crop as any other. If we want to further disfigure our lands we can do it

sooner by raising this crop than any other. It returns no crop elements to the soil. Most crops do, more or less. Morally, tobacco induces more injury to the youth than whisky.

Dr. Bond, of Blount, had been using tobacco many years, and was bound to say its use is an evil and had impaired the health of many. But it is a question of money. If profitable, let us raise it under judicious cultivation; somebody will raise it.

S. T. Powers, of Kentucky—In Kentucky, where the soil is strictly limestone they make it profitable. He believed East Tennessee adapted to its profitable cultivation.

J. B. Stokely, of Cocke, offered the following resolution, which was unanimously adopted:

Resolved, That it is the sense of this Convention that the cultivation of tobacco in large quantities in East Tennessee should be discouraged.

WEEDS—BY J. K. P. WALLACE.

“Weeds” was the subject of an essay by J. K. P. Wallace, of Anderson County, and is as follows:

The subject of this essay is as old as the everlasting hills, if not as old as time, and pestiferous as the evil one himself. In the very morning of creation the baneful curse, that “thistles and thorns it shall bring forth,” went forth.

“It is the first thing that engages the attention of the boy farmer, before he is even three feet high, and takes up the implements of warfare, the hoe, the plow or cultivator, and it greets him as periodic as the seasons, until he lays aside these implements at the evening of life, to be taken up in turn by a successor who must follow the same course. And yet, with all his labor and conflict, no more than a temporary advantage has been made—no species has been extinguished. Though cut down to-day, they may spring up instantaneously, ripen and scatter their seeds in a day to the four winds of the earth. Instead of reducing their number, we find, year by year, through some evil channel, a newcomer has made its way into our fields and added to our already too extended list.

Weeds are a strong negative force in our agriculture—a due subjection requiring eternal vigilance and war; yet the toiler gets no reward.

Botanists enumerate almost an infinite variety of weeds. We, for present purposes, content ourselves with such as we come in daily contact with—old acquaintances, for which we manage to have common names (and little use), and though not much botanist, we are exceedingly familiar with their habits and the evils they bring.

To enumerate the list of well-known weeds—native weeds of East Tennessee—would make you all tired. Some of our friends may tell us it is practicable to substitute grass or valuable plants in their stead; that weeds are sign-boards of laziness or carelessness. In this there may be truth; but even so, they are heritages for which we are not responsible, and we must battle and battle against them—subdue and eradicate as nearly as possible—keep a keen outlook for newcomers, and dispatch them root and branch upon first appearance.

Their polluting effect extends to all crops cultivated by the hand of man. They are no less vigorous and obstructive in wheat, oats and the grasses than in the more cultivated crops of corn, vegetables and roots, and the amount of injury they do cannot be estimated. Were it possible to annihilate them, and substitute instead the nutritious grasses and other valuable crops, then this country would be infinitely rich. Could the land they occupy in our State be turned into a profitable crop and appropriate the results judiciously, I dare say our debts taxes and mortgages would melt away as the dew before our morning suns. They stand in the way of general agricultural prosperity as a mountain reaching beyond the eye of man.

I can conceive of no use or even compensation they serve for the great detriment they involve. Doubtless in the wise economy of creation, they, like everything created, are good. A great majority have their medicinal and succulent values, and may be classed as blessings. Against these there are many varieties for which I can conceive of no use, except as plagues, which stand not only for what they appear, but are polluting.

If we could make an intelligent discriminate selection, separate the good from the evil, exterminate one and properly limit the other, we could be a little charitable toward them.

I regret that it is impracticable to classify and point out their many distinctive uses and abuses. I must say that the list of our own ordinary native weeds is sufficient for all ends. They are perhaps too widely diffused to admit of extinction. We can only hope for a temporary abatement, and there is no royal road to success especially short of a ceaseless battle against them. There are, however, a few weeds of recent introduction that demand a most determined, concerted vigilance on the part of all, and which if not immediately taken in hand, this season, and promptly cut or cleared away threaten an evil only a little less aggravating than the ancient plagues to the children of Israel. In comparison with them and the detriment they do, all others are insignificant. I refer to wild carrots, sheep sorrel and field daisy. The wild carrot is classed as of the same species as domesticated carrots. It is an introduced plant, coming from Europe, biennial, and spreading principally in highways, hedges, neglected lands and cultivated lands. It may be somewhat abated or checked by close pasturing. Cows and sheep will eradicate it. It seeds only the second year, but cannot always be cut close enough to prevent seeding; it must be cut close or plowed up deep. Its seeds are light as air, and carried by the wind to a long distance. But a few years since it was not to be found in our section of the country. Now its white defiant plumes float in the breeze in all directions. It is yet time and possible to destroy it by a continuous battle against it. A few years, if we continue to neglect, and our lands will be a sea of white from its blooms, and the soil wonderfully depreciated. It begins to bloom about the 10th of June, and continues to do so until frost nips it. I cannot do you, gentlemen, a better favor than to warn you against its appearance. I think a man would do a religious duty were he to go hundreds of yards to pluck it up, when in bloom, even on the Sabbath. It will multiply the first seed year by the thousand, and with the two following weeds is to be despised second only to Satan. We get it through our field seeds from other sections of the country, and I fear ours will be the fate of New England and

the overrun sections. The daisy is also a newly-introduced plant. Plowing, close feeding with sheep, high manuring are the remedies. The seeds ripen if cut in full bloom—so daisy hay is not safe. I have seen meadows in my county almost completely overrun with it. It should be fought as a deadly enemy. It is also perennial.

Sorrel is another perennial, and spreads in worn land when clearer seeding fails, and soon covers the entire field. It is exceedingly tenacious of life. Its long fibrous roots seem to thrive best when carried to different parts of the field on plows. It will almost take root upon a stump. It is nearly impossible to destroy it by tillage, and though eaten by stock they will not eat enough to prevent it seeding. In small areas it may be extirpated by a complete covering some twelve or more inches with straw, thus smothering vegetation. It is now just maturing its seeds, and should be carefully controlled.

To these may be added the famous Canada thistle and wild onion, an evil companion, now, perhaps, sparsely introduced. This will perhaps complete the list of dangerous newly-introduced weeds, and where yet only found in small groups you had best put in much time in attempting their entire destruction. I am very fearful that through our very rapid means of diffusion and introduction of new seeds, from those sections where these weeds abound, and our carelessness or indifference, that our own fair East Tennessee will become as unfortunate as other plague-stricken sections. If we are not a little more watchful and vigilant the next decade, even, will find these pests so well established that our lands will be depreciated in value one hundred or more per cent.

It is high time we should put our best thought and energies to the destruction of all these great enemies. A wise policy, and a due effort will make us masters of our own, but carelessness or indolence will make these pests masters of us, and our fondest hopes shall perish. We should ever remember that one stroke in season, against these enemies of our prosperity, may spare ten thousand a year hence.

In the beginning the Great Creator placed man in Eden, the fairest of earthly places, and directed him to dress and keep it.

Shall we of to-day, possessed of no less fair heritages, neglect the obvious duty of tending and dressing the lands we have?

The promise and reward and honors are to the diligent and there never was a time in the world's progress that greater care, energy and intelligence were needed to subdue the evils that lie athwart the path of happiness and prosperity, than the present.

Professor Glenn thought much of the weeds were introduced into this country by the seeds and that a more careful examination into the seeds should be made. The great need was right seed wheat or oats and grass, then the trouble might be lessened, and advised the establishment of a seed farm where care would be taken to separate the weed seed from the good seed.

Isaac Emory, of Knox—There are moral as well as field weeds that need to be eradicated. Weeds are useless and troublesome. If the ox-eye daisy alone is not eradicated it will cost the farmers thousands of dollars. One man can introduce enough cockle seed to contaminate the whole State of Tennessee.

A man violates God's laws when he allows noxious weeds to grow and scatter as much as he who steals his neighbor's corn. Good citizens strive to keep down these pests.

Colonel Meek, of Jefferson—We cannot at this date stop the growth of weeds no more than we can rats and mice and other evils. They are here to stay. Laziness, however, is the great opportunity for them to grow.

Professor Glenn—This is an important and practical subject. A due subjection of weeds is the brightest evidence we have of man's superior knowledge, energy and tact, a systematic co-operation among farmers is the only way to their due extermination. Guard against sowing contaminated grass and garden seed.

J. K. P. Wallace—A farmer should know the uses and evils of everything that grows on his farm—should watch with jealous care the appearance and habits of all new weeds, and de-

stroy all evil ones before they get too good a foothold, meanwhile fight with eternal diligence at *blooming time*, or earlier, all noxious weeds.

GRASSES—BY C. W. CHARLTON.

I have long since been forced to conclude that grass, and more and better use of it, is the salvation and hope of our country. There can be no surer test of agricultural advance than by the relative acreage of land in grass, as the other system of exhaustive crops indicates degenerating tendencies. Farmers should know the needs and capacities of their land. Grasses here have various uses and adaptations; let them sow with a liberal hand that which will best grow on his land, and give it the best possible after-treatment, and most gratifying results must follow. Too much grass and clover is destroyed by excessive pasturage the first year. I am an eternal enemy of sedge grass. Believe it should and could be thoroughly eradicated. He read extracts from Commissioner McWhirter on grass, and referred his hearers to the value of the report, and also to the many valuable and standard works within easy reach of the inquiring farmer.

Dr. Gillespie, of Knox—How can we get a stand of grass on poor worn-out hill-sides and gullies?

Rev. C. B. Lord, of Blount—I have sown seed as late as November, broadcast, with from fifty to one hundred pounds of standard fertilizer to the acre, with most gratifying results. I sowed and did not cover. By experience I have found a good set of grass on ground not plowed, where it perished on well prepared land.

THE FENCE PROBLEM—BY J. J. M'CORKLE.

The last subject for the afternoon was "The Fence Problem," by J. J. McCorkle, of Carter County. Mr. McCorkle spoke as follows:

MR. CHAIRMAN AND GENTLEMEN OF THE CONVENTION: The word fence is very small in itself, but when we realize its meaning in the full sense, we can see at once that the field of thought

is as broad and as long as this great land in which we live. This field of thought is so extensive that we will not attempt to discuss it all or give in detail all that might be said on the subject. We think the problem that should interest us most at the present is, should our present law regulating fences be continued, or what plan or system can we adopt that will reduce the expense of fencing and stop the destruction of our timber; what is the expense of fencing, and who is to be benefited by such laws or changes as these.

We insist that our present law is burdensome to that class of people who till the soil for a living; it keeps them on the defense all the time, and takes up too much of their time that would be profitable to them spent in some other way. The man that invests his money in land has a perfect right to buy from whom he can, and when he has thus done, he has bought all that pertains to that farm or lot of land. No one has any right to cut his timber, to carry off his fruit or share the benefits of his garden. If this be so, why not protect his grass, his crops and all that he has, and take him off the sentinel post of defense and allow him the unquestionable right to do as he pleases with his hard-earned dollars? All that is just and good demands it.

The poorest man and his family in their little cottage should have the same protection as the richest, surrounded with all the heart could wish.

But should the man who owns land be forced to spend as much or more than his taxes to ward off and protect his crops? No man begins at the top of his house to build, but first lays the foundation. No man should try to raise stock until he has made some arrangement to feed them. To allow our stock to trespass on our neighbors breeds ill-will and causes lawsuits. The hungry cow and hog will satisfy themselves when they are allowed to run at large, and the farmer is often damaged by another's stock who is as able to keep his stock as the farmer, but wants to raise a good lot of cattle, sheep and hogs at the expense of his neighbors.

It is said that such a rule would be grievous to poor people. We insist not. It would be far better to feed his cow for him

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than have more destroyed in one night than would feed her for two weeks. But if the law required a man to keep his stock in his own inclosure, every man would at once prepare him a patch of grass for his stock, which would not require any more time than it takes to look after them when allowed to run at large. The greater objection to the present law is the destruction of timber in our country. The man who will but look back twenty-five years and think of the broad acres of timber that were in our State and compare it with the present, can see at sight where we are drifting. No one will deny that we have used one-half of the available timber we had suitable for building purposes, and that one-half of that amount has been used and shipped in the last six years. We should think of the increase in population in our State and the amount of demand on our timber. We can see at once that the time is here and not in the future that the hand of destruction should cease in our forests for fencing purposes. My observation in my county and adjoining counties is, that unless there is a change in this direction within ten years the lumber that we are now selling and shipping for \$15 per thousand will be in demand in home markets at \$25. The county in which I live is small in comparison to some, but about an average of the State. We have had ten steam and twenty-five water-mills cutting lumber for five years. Suppose, which is reasonable, that each mill cuts 3,000 feet per day, this would make 100,000, and we ship one-fourth that amount of logs, and car-load after car-load of staves, and for the last four years there has been an average of a thousand cords of tanbark peeled in this county, and at least two-thirds of the timber left to spoil. From reports, I see that this is the case all over East Tennessee; probably not so much as in Carter County, as we have the advantage of two railroads, one running the full length of the county and through the best belts of our timber. If this is continued for the next fifteen years, the question of fence or no fence will settle itself. We have 175,000 farms in the State, and there is one-fourth of that number destitute of timber of any sort that is fit for lumber or fencing; one-fourth that could probably be fenced by using all that is on it. One-fourth of them have plenty, but none to sell. The remaining one-fourth is in mountain land, and would

incur such an expense that we cannot afford to get it off for fencing.

We should examine the cost of fencing. As I before stated, we have 175,000 farms in this State, at an average of 120 acres each of farming land. To build a nine-rail fence around this it requires 500 panels, or 45,000 rails, at a cost of \$3 per hundred; total cost, \$157.50. It takes up one and one-half acres of land to sit the fence on, at a cost of \$15 per acre; five days for cleaning and five days for repairing, \$7.50; interest on the amount invested, \$10.80; total cost, \$190.80. Suppose the fence to be rebuilt in fifteen years, \$12.72 per year, which exceeds the taxes we pay on the same land.

But one of the most important features in this question is the difference in feeding stock and allowing them to run out on the grass. There is no farmer that will deny the fact that there is a saving of one-third by cutting and feeding, and that the manure saved will pay for the extra labor.

There is much more that could be said on this subject. But will say that every man, whether a farmer, merchant, mechanic, lawyer or doctor, should have the one great aim in view, and that is, to look to the welfare of all, at the present and in the future generations. Let us not go on at such a break-neck speed in destroying our timber in order to meet the present demand that is on us, but let us cultivate the land that is now lying out and bleaching by the hot sun, not even a blade of grass to shade it, which is bringing ruin and poverty to our midst. We should not rob our children of every stick of timber that they will so much need in the future. The old adage that each generation must provide for itself, will bring devastation and ruin to all mankind. Let us take a front view of the situation, and ask our law-makers to make us such a law as will decrease our expenses and result in good to the future generations.

At the close of Mr. McCorkle's address, the following resolution by Col. O. C. King, of Hamblen County, was passed:

Resolved, That the farmers here assembled favor the repeal of all existing fence laws, and that a law requiring each man to fence his own stock be enacted.

A rising vote showed 49 for and 18 against the motion.

Colonel King, of Hamblen—I am in favor of a no-fence law. There are many cases where it would doubtless prove hard, especially with the smaller farmers and renters, but men owning the better lands near by could better afford to give these men pasture than to be, as now, compelled to keep up an expensive and destructive system of fencing.

Mr. Lynch, of Greene County, was in favor of a hog-fence law.

Mr. Taylor, of Anderson—If any stock runs at large, let it be hogs.

Mr. Stokely, of Jefferson—At least one-third of the land of East Tennessee is unfenced, and it would prove a hardship on many if there was a no-fence law.

Dr. Bond—It would be better to pasture for small farmers than to have their stock at large.

Mr. Cate, of McMinn—The fence problem is one of the most perplexing that confronts the East Tennessee farmer. A no-fence law would be now perhaps premature, but he hoped to see the day when the movement would have the benefit of statute enactment.

Mr. Stokely—What would you do with a man with stock and no land?

Mr. King—Mr. Stokely's fencing perhaps cost him \$500 per year. He could pasture his share of other and less fortunate people's stock for \$200, a saving at least of \$300 per year. This is probably not an exaggerated illustration. A few years since he had occasion to take a horseback ride through portions of South Carolina. On his first travels he saw the most shabby and needy kind of stock rooting here and there, and the country seemed on a par with the stock. Presently he came to a gate across the road, in another county where the no-fence law prevailed, and he was most forcibly impressed with the change in evidence of more striking prosperity in all directions. On subsequent trips he found the whole county had adopted the no-fence law.

Mr. Burnett, of Cocke—There are many counties in Tennessee that would receive great benefit from a no-fence law.

J. K. P. Wallace—The law would seem impracticable to East Tennessee, emphatically a stock country, where our best farming calls for fattening and marketing live stock. On roads leading to our principal market towns stock of some kind daily line the road, and it was hardly possible to prevent depredations on adjacent valuable crops. But farmers should very much economize in the matter of fencing and destruction of timber therefor.

Rev. Mr. Emory—In New York the poor people herd their stock, and are benefited by the no-fence law.

Col. J. H. Morrison, of the East Tennessee Hedge Fence Company—I am neither for nor against the law, and am both for and against it. Wherever the no-fence law exists within my knowledge it is local, and not a State law.

The question was then submitted to the Convention in a formal way and was defeated by a vote of 49 to 18.

NIGHT SESSION.

In the absence of A. A. Taylor, of Carter, Capt. J. A. Turley, of McMinn, addressed the Convention upon the subject, "East Tennessee, Past, Present and Prospective." The address was replete with valuable information and suggestions, and it is a matter of regret that it is not practicable to accompany these proceedings with it.

Judge Temple, Chairman Committee on Manufactures, presented the following report:

In the very brief time permitted for the preparation of this report it must necessarily be very short and imperfect.

Agriculture and manufacture must, in every well regulated community, in every rightly adjusted system of economy, go hand in hand. They are as the Siamese twins. Sever the cord that unites them and both must languish. For nearly one hun-

dred years East Tennessee was without manufactories; the result was poverty, stagnation and non-progress. There was a surplus, but no purchasers; plenty, with no money; labor, with no employment.

In the course of time manufactures came cautiously. As they grew stronger, more confident, the number increased. Wherever they appeared they gave new life to labor, incentives and new rewards to agriculture. That neighborhood so fortunate as to have one was blessed with a prosperity unknown to less fortunate localities. Lands as well as agricultural products were enhanced in value. The reason is plain; they create a home market, the best of all markets.

Year by year these manufactures increase and multiply in our section. But, compared with the great future before us, the wonderful development yet to be made in manufactures, we are as yet in the very infancy of this development. Prophecy cannot foretell the wonders of the future. In our iron, coal, marble, zinc and timbers, combined with a mild climate, productive agricultural resources and unlimited water power, the future is bewildering in its bright hope and promise of wealth and greatness for its most favored region. The hum of industry, the whirl of spindles, the blaze of furnaces, the rattle of machinery, and the heavy breathing of leviathan-like engines shall be heard in all our cities and villages, and in every valley.

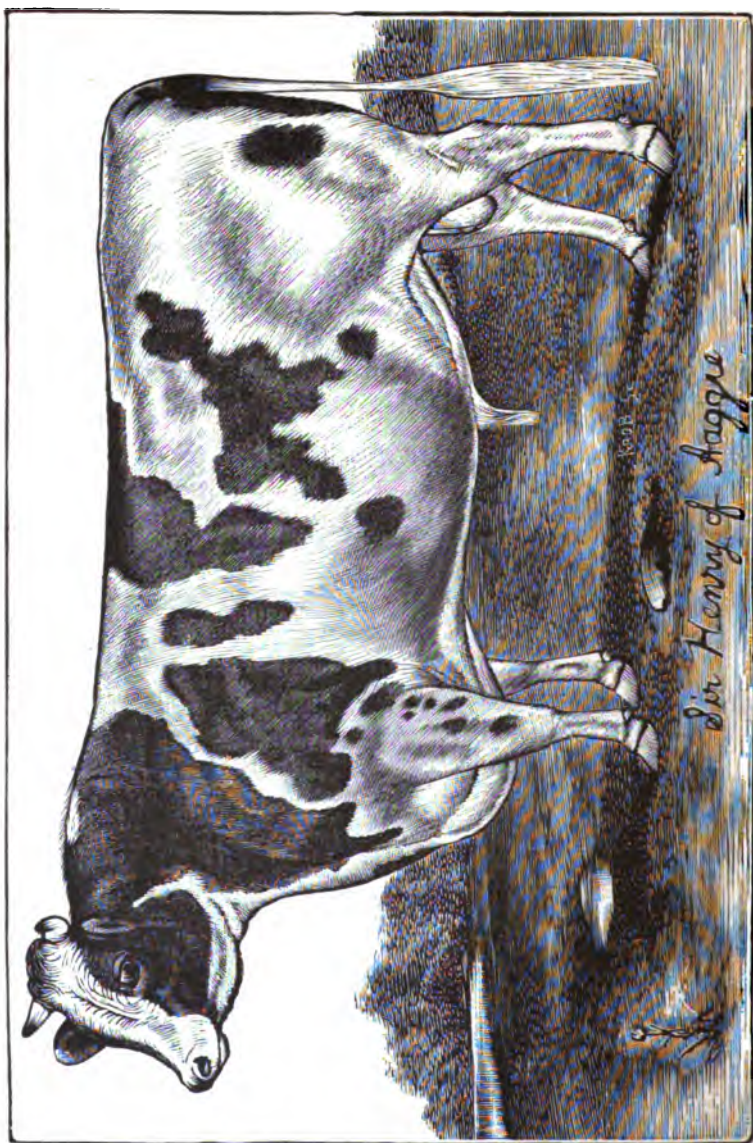
O. P. TEMPLE, Chairman.

On motion of Maj. A. J. McWhirter, Commissioner of Agriculture, the report was received and adopted.

J. K. P. Wallace suggested that there are some representatives of the Nashville press present, and on his motion the courtesies and privileges of the Convention were accorded them and any other representatives.

Col. J. O. Griffith, representing the *Union*, said, that as the youngest member present, he would tender grateful acknowledgments.

Col. O. C. King, of Morristown, was called upon, and also, in an impromptu manner, delivered himself quite eloquently



Imported Bull SIR HENRY OF AGGIE—Property of EUGENE SMITH, Nashville, Ten

on the subject of the possibilities of East Tennessee, and closed by proposing a resolution on the opening of our river.

G. W. Pickle, of Dandridge, was called upon, but only stated that, fortunately for himself and the Convention, he had lost his voice and could not speak.

Hon. O. P. Temple, of Knoxville, responding to a call, made an excellent and appropriate speech on this subject.

On motion of Dr. J. C. Gillespie, of Knox, Colonel King's resolution was adopted, and is as follows:

"Resolved, That the Representatives of Tennessee in Congress, and of other States watered by the Tennessee River, be and they are hereby urged to use their best efforts to obtain a liberal appropriation for the development of the Tennessee River and her tributaries."

J. K. P. Wallace offered the following, which was also adopted:

"Resolved, That this Convention request our Senators and members of Congress to use every honorable effort for the furtherance of the passage of the following bills, now pending the action of Congress, viz: A bill to advance the Commissioner of Agriculture to that of a Cabinet office; a bill increasing the appropriation for extending the signal service to all Agricultural communities permissable; a bill to suppress the manufacture and sale of imitation butter, by requiring a revenue tax upon the same of not less than ten cents per pound, under other proper restrictions."

Col. J. A. Turley said there had been some talk of Chattanooga contesting for the next session of the Convention, and moved to fix the time and place.

Col. C. W. Charlton seconded the motion, with an amendment nominating Chattanooga as the next meeting point, accompanying his second with a speech favoring Chattanooga, mentioning a cordial invitation sent through him by A. S. Ochs, of the *Times*.

Col. O. C. King offered, in lieu, a motion to fix the time as Tuesday, after the third Monday in May, 1887. Carried.

Colonel King then nominated Knoxville as the place.

Col. J. B. Stokely rose to a point of order, the point being an amendment to an amendment of an amendment.

President Meek decided the point not well taken.

Colonel King then advocated Knoxville as the meeting point, and after he was through, President Meek announced that Colonel Stokely's point was sustained.

Colonel King appealed to the house, and was sustained by a vote of 36 to 15.

After remarks by Messrs. C. W. Charlton, J. J. Burnett, J. A. Turley and Geo. D. Cate, favoring Chattanooga, and by Cols. H. H. Hubbard and O. C. King, favoring Knoxville, the vote was taken and Knoxville selected.

On motion of Colonel Turley, the Convention accepted an invitation sent by the citizens of Chattanooga, through Colonel Charlton, to meet with the Northern Citizens' Convention in that city in September, and, on motion of Colonel Hubbard, the Vice-Presidents were instructed to appoint delegates.

Col. J. A. Turley offered the following, which was adopted:

"Resolved, That this Convention hereby appoints Hon. C. M. McGhee a committee to secure the lowest rates of travel possible over the railroads centering in this city for farmers attending its next session, as also to delegates to Chattanooga, and respectfully request him to act."

Adjourned till 8 o'clock to-morrow.

SECOND DAY.

The East Tennessee Farmers' Convention, setting in its Eleventh Annual Session, re-assembled at the United States Court-room at 8 o'clock Wednesday morning, and was called to order by the President, Col. John M. Meek.

Prayer was offered by Rev. C. B. Lord, of Blount County.

J. K. P. Wallace, of Anderson, offered the following :

“Resolved, That a committee, to be styled the Committee on Fairs and Farms, and to be composed of five members, be appointed by the President of this Association, whose duty it shall be to visit and inspect the workings of as many fairs throughout East Tennessee as may be practicable, and report the same to this Convention at its next meeting; to visit in a body, before the annual meetings of this Association, the State Agricultural College and experimental farm therewith, and carefully inspect the practical work, and such other farms as may be convenient, and make report to this Convention.”

Vice-President Geo. O. Cate, acting President, announced the following as the committee provided for in the resolution presented by J. K. P. Wallace, and given above :

Col. John M. Meek, of Jefferson; J. J. McCorkle, of Carter; E. F. Sharpe, of Meigs; J. B. Stokely, of Jefferson, and C. W. Charlton, of Knox.

Mr. Lord—This a most important move.

Mr. Remine—Was specially pleased with the resolution and its purpose. If the intent of it was properly developed great good could but result.

Mr. Snider, of Knox—Heartily indorsed the move.

Mr. Burnett—We ought to be a practical people. A man improves his farm, but if it costs more to raise certain crops and there be no other compensation, we had better do something else. But with the well developed experiments of our State Experimental Farm before us as a sign-board, we ought to avoid many useless experiments. The average farmer does not have time nor means to make many exhaustive experiments. The University has all needed facilities, and it is their mission to do so and send the knowledge throughout the land.

We must raise and do what we can for ourselves and families with what we have. To make good citizens of them, educate and give them as good a start in the world as possible.

Mr. J. B. Stokely, of Jefferson, opened discussion on

“ FARMERS MISTAKES.”

The greatest mistake many so-called farmers make is in attempting to be farmers at all. Too many are slipshod excuses. Again, too many go to farming, get discontented and wander off into the misty realms of law, politics, or something else. Any “ fool ” might make a lawyer, doctor or merchant, but only a level-headed, clear-minded man could be a successful farmer. A common mistake is they are too prone to run after novelties in farming or enterprises to the neglect of the solid duties of their business.

We are too impatient for results. We plant to-day and expect to reap largely to-morrow, and if we do not succeed we venture into visionary things, and change without intelligent purposes.

Mr. Remine, of Greene—Farmers are too diffident in participating in these annual meetings. One of the most vital mistakes we can make is a failure to educate our sons and daughters to be farmers and farmers’ wives.

If we have a son inclined to be bright he is always educated for professional life. The slow son is invariably put behind the plow, making rails, or some other menial work, and his intellectual training sadly neglected, with the idea that he is unfit for anything but a clod-hopper. So of the daughter. If especially good looking and bright she must be pampered, she must be sent away to college, in good society, to be the wife of some lucky-go-easy professional man. But if she be ordinary she goes to the wash-tub or kitchen to make a menial wife for some farmer.

These are the greatest injuries farmers do their calling. It takes a man with a long, strong head to make a successful farmer. As a fit companion he should have one of God’s nicest handiwork—a noble, true woman, to stand with and help him in the many struggles he must encounter.

Another mistake is failure to be organized. Every man’s hand from the lordly autocrat to the most despicable tramp that plods the road, is against the farm. Every other interest can readily organize. Let us be wise as serpents and not always harmless

as doves. We must raise stuff for every one, and every one makes it his business to get our products at the lowest possible price.

He cannot be a fool. He must know something of law, not for aggression, but self-defence. He should know enough to maintain his rights without courts or lawyers. He must know something of hygiene. Doctors combine, if he is able to pay, and keep him sick. He should know something of farm sanitation. Teach your boys continually that they must be practical.

Early in the war an old gentleman from Virginia concluded he would like to be a General in the Federal Army. He went to Washington. He was ushered into a richly upholstered place. He was told to solve a question of decimal fractions, in which he did not succeed very well, but he left in a huff, with the information that they (the Government) was badly mistaken if they hoped to conquer the rebellion by decimal fractions. So if we aim to make a success of farming in East Tennessee without proper and careful attention we are equally mistaken.

Mr. Ledgerwood, of Union—Give the boys a practical education. He had attended the school of the University of Tennessee, got some good theory, and, contrary to the usual custom which decrees that a man with above mediocre education shall take a profession, he returned home and found the knowledge gained of much advantage in practical work.

Our farmers do not take enough interest in home adornment and in supplying their families with farm and current periodical literature, which may be the base of the best possible education.

Farmers should be the most intelligent of men; to be so they must study and read. A good, conscientious professional man, is an honor to himself and country. But quacks are as millstones in any business.

Fix good impressions on the young mind at an early time. If more care was used to teach the youth that farming was the noblest of all callings then they would eventually drift back to the farm.

Did you ever think that of the one hundred and five persons who came over on the Mayflower, thirty-five were graduates of one of the best colleges in the Old World, and yet with their knowledge and energy they made that sterile New England soil bloom as the rose.

Dr. Bond—Farmers do not pay enough attention to the strong or leading inclination of their children, and then educate them in the direction of their characteristics.

INDUSTRIAL DEVELOPMENT.

ADDRESS BY THE HON. A. J. McWHIRTER, OF NASHVILLE, TENN.

The panorama of ages as it unrolls before us is a picture of evolution. I do not use the word in its technical theologico-scientific sense, but in that practical sense in which it was used before the triangular duel of genus, species and variety began to rage on the fields of natural history.

There is, perhaps, no study more interesting than the *aionian* development of history—the study of eras, and the causes of their changes; and as we pass through them we find one force determining by a fixed principle all development in accordance with the peculiar environments of that time.

“ For I doubt not through the ages
One increasing purpose runs,
And the thoughts of men are widened
With the process of the suns.”

The sociological eras of history show how steadily this purpose moves toward fulfillment of the world's great destiny.

Step by step it has advanced until the blaze of the nineteenth century lights up the past, displaying seven grand historic periods through which the world has come, to the present day.

Let us review them in the order of their development, and see how the evolving principle of the universe has brought us to what we are. Seven eras mark the progress of the world:

1. The Agricultural age.
2. The Patriarchal age.
3. The Philosophic age.
4. The Martial age.
5. The Religious age.
6. The Political age.
7. The Industrial age.

Beginning with the first, the

AGE OF AGRICULTURE,

we assume the correctness of the Mosaic cosmogony, or at least we presume upon the beginning of the human race at that time, when it turned the soil for culture and relied upon its production for physical support.

The physical needs of man in his primitive state necessitated the development of agriculture as his first science, and, by the way, when husbandry came into the field, even at that early day, it caused the first *strike*—one, alas, the echoes of whose awful tumult comes sounding down the long aisles of time and mingles with the horrid din that fills the air of to-day in the crowded centers of civilization.

But to return: The establishment of a permanent and positive basis of support in the culture of the soil and its allied pursuits, which come naturally within the domain of agriculture, gave man fixed abodes and made it possible and profitable to him to gather about him, on his almost boundless inheritance, the generations of his blood. This was the dawn of

THE PATRIARCHAL AGE.

Under the old patriarchal system, with an accepted theocracy, it might have been supposed that men could have been content. But "the spirit of man which goeth upward," in its restless activity reached after grander ideas of life. Still preserving

the patriarchal order, they built cities and peopled them with their tribes, and called upon God for a human king, who, being given them, still kept up the order, but from his rulings came the adumbration of another system which should revolutionize the world. Prophets came on the field of development, philosophers arose who had broken away from the old Jewish patriarchal theocracy, and men began to think for themselves, and the traditions of the fathers crumbled into dust. Then came on

THE PHILOSOPHIC AGE.

Mythology took hold of the human mind, and imagination peopled the universe with beings weird, eldritch and fantastic; gods and demigods spoke to the fancy, and agriculture and industry were irradiated with a poetic glow. There was a nymph by every brooklet, a Ceres in every field, an Eolus in every breeze, a Neptune in every ocean-storm, and a Jupiter in every thunderburst; the Lares and Penates hovered over every hearthstone, and a muse inspired every perception of the intellect and every sentiment of the heart. This paved the way for the cold reaction of dialectics, and pure philosophy held her undisputed sway over the minds of men. The progress of industry seemed for a time to be paralyzed. Men left the anvil and the plow to crowd the porch, the academy and the grove. Then came out of this intellectual clangor the mad thirst for conquest. And just here let me say, *en passant*, the paralysis of industry is ever the precursor of war,

" For Satan finds some mischief still
For idle hands to do."

But we shall refer to this further on. The shock of conflict shook the civilized world, and

THE MARTIAL AGE

was ushered in by the trumpet notes of battle, and for many long and troublous years the world was one great field of carnage, until weary and worn with contest and with conquest, men turned back to literature, and under the scepter of the

great Augustus, the temple of Janus once more was closed, and the world was at peace. Now breaks upon us the grandest figure in the march of ages, around whom crystalized all that was grand and glorious in humanity, and announcing to the world a system which triumphed over all the past, gave power to progress, proclaimed the downfall of pagan Rome, and ushered in a grander civilization than the world had ever known. So strong a hold did it take upon humanity, that with wild fanaticism in the name of religion, men crowded to the standard of the cross, and made the Prince of Peace their minister of war, and their authority for bloodshed.

Upon the darkness of that awful time another star arose which rivaled that of Bethlehem. It was the star of empire.

THE POLITICAL AGE.

was ushered in. The world became mad with revolution, and dynasties trembled to their base. The surging oscillation between monarchical and popular power forced the rulers of the world into a general struggle for imperial sway. Political intrigue was sustained by costly armaments and bloody conflicts, until the sun of heaven shone down upon desolated fields, unfilled barns, closed storehouses, empty treasuries and ruined people. Republican government cut the Gordian knot and the voice of the people cried out against being moved like puppets over the chess-board of kings. Co-operative systems of government were established in which representation became the basis of all legislation. The doom of autocracy was sealed and the political age was virtually at an end. Now what next?

With one tremendous impulse nations bounded into industrial pursuits. Agriculture and commerce, mining and manufacturing filled the great heart of the world with life-giving blood, and the pulses of national wealth throbbed with the fever of industry. The air vibrated with the roar of the furnace and the factory, and the disemboweled earth groaned in the agony of labor, but cast the smile of a mother upon her delivered offspring.

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We can pursue this line of thought no longer. We are brought face to face with the realities of the present. We are in the midst of

THE INDUSTRIAL AGE.

Great issues are before us. Stupendous industrial schemes are pouring in upon us with such rapidity as almost to make the reason reel. Like some great engine of tremendous power, the world is quivering with its own momentum, and the works of humanity are like unto those of God himself. The great problem of the hour is the regulation of this machinery so powerful, so complex and so vast.

In no country in the world does this question take such broad significance as in the United States of America. Its political principle of equal rights to all men stands out in bold relief before every tendency to centralization, either in government or industrial economy. No greater issues were ever brought before the world than those which face us to-day, and we dare not shirk their consideration. We can play the ostrich no longer.

Let us take a calm review of the field upon which the great forces of labor and capital are marshalled to-day, and analyze the conditions of industrial development which exist among us.

The scope of this address does not allow of a full discussion of industrial development throughout the civilized world to-day, nor even throughout the broad expanse of the United States. It is enough for us to consider the development of our own industries in the States we represent, for from the present tendency of industrial interests it is in the South especially that a full solution of the great problem is to be finally reached.

From the Baltimore *Manufacturers' Record*, than which there is no better statistical authority, we find that the amount of capital, including capital stock of incorporated companies organized during the year 1885, and that used in enlarging and rebuilding structures destroyed by fire, aggregates \$66,812,000, divided among the fourteen Southern States, as follows: Alabama, \$7,841,000; Arkansas, \$1,220,000; Florida, \$2,019,000; Georgia, \$2,500,000; Kentucky, \$18,304,200; Louisiana, \$2,118,500;

Maryland, \$6,668,500; Mississippi, \$761,500; North Carolina, \$3,230,000; South Carolina, \$856,000; Tennessee, \$2,692,000; Texas, \$3,232,000; Virginia, \$3,814,000; West Virginia, \$12,056,000. Total, \$66,812,000.

Summing up some statistics of the South's progress since 1880, the *Record* shows that since then 10,400 miles have been added to the railroad mileage of the section, the building of which, added to the investments in old roads and their improvements, foots up \$571,000,000; the actual cost of the railroads of the South and their equipment, according to statistics, being over \$1,250,000,000, against \$679,800,000 in 1880. Her cotton mills have increased from 180 to 353, almost 100 per cent., and in spindles and looms the per cent. is almost the same. In 1880 cotton-seed oil mills numbered forty; now 146, with a capital of nearly \$11,000,000, or more than three times the amount five years ago. In 1880 the South made 397,301 tons of pig-iron, and 1884, 657,599 tons. Coal, phosphate rock and other mineral products have developed in almost equal ratio.

Now turn to agriculture. The corn crop has increased from 334,000,000 bushels in 1879 to 499,000,000 in 1885—a gain of 165,000,000 bushels. Oats have nearly doubled in production, and the same is practically true of tobacco, fruits, vegetables, grasses, etc. In 1880 the live stock of the South was worth \$439,900,000. At present its value is \$599,600,000, or a gain of \$159,300,000. So that, taking a general resume of the increment of interests in the South, we find that she produced in 1885 \$300,700,000 more of agricultural, manufacturing and mining products than in 1880, and is now enjoying the full momentum of the splendid impulse that she has acquired. This is a little more than the average value of the cotton crop, and \$25,000,000 more than the total value of the wheat crop of the whole country for the past year. And, in this connection, we can with pardonable pride refer to the assessed value of property in the South, which has increased nearly 1,000,000,000 since 1879.

To bring this matter still closer home to us I refer you to the development of particular industries in our own State of Tennessee, which were comparatively unknown before our civil war. In 1880 Tennessee produced only 78,000 tons of pig-iron,

and in 1883 she produced 133,000. According to the weekly output of all the furnaces now in Tennessee, she will produce 328,600 tons during the present year, and from the most reliable information obtained regarding the products of the cotton, woolen and saw-mills of the State for 1885, each of these industries show an increase over that of 1880 of more than one hundred per cent. The cities and commercial centers of the State show a corresponding increase in the matter of population—for example, your own city of Knoxville was credited with a population of 9,693 in 1880. You now have more than 23,000. Chattanooga had 12,892 in 1880, and it now has more than 25,000. Jackson had in 1880 5,377, and it now has 9,000. Memphis had 33,592 in 1880, and it has now more than 65,000, and Nashville had but 43,350 in 1880, and now has 70,000. And yet, with all this, we have sounding in our ears like a Cassandra prophecy the cry of

INDUSTRIAL DEPRESSION.

What is the cause of it? The vast increase of capital must be the result of a vast increase of diversified labor. They cannot be disassociated. Whatever antagonism may arise between labor and capital, it is a standing axiom that they must be reciprocal to insure productive results. If there be over-production and under-consumption, the trouble could be remedied by establishing proper commercial relations with those countries that need our products, and from which we can receive in return those products which cannot be obtained in our own land. But even this is not required.

The Chicago *Inter-Ocean* of March 25, in an admirable editorial upon this subject, reviewing the report of Commissioner Wright, thus remarks: "There is a factor in the problem which Mr. Wright does not take into account, judging from the summaries of his reports thus far published, and that is the demand created by the supply. New wants and increased demand for the old staples of supplies, have almost kept pace with the acceleration and augmentation of supply. For example, before the days of machine-made boots and shoes a very large proportion of the children of the country went bare-footed, except in

winter, and not a few adults did the same. There can be no over-production in point of fact, until every industrious and frugal man can keep his entire family well shod the entire year round. The principle herein illustrated runs through the whole range of necessities and comforts, reaching to many things which, without machinery, would be classed as luxuries. The humblest laborer, if his habits are good and his family healthy, may enjoy more real comforts and luxuries, even, than all the silver of Peru could buy when that country was being plundered by that thief of the world, the Spaniard."

There is a fact which, unfortunately, is too often lost sight of in the discussion of this question, and that is, that each person is not only a producer, but a consumer, and the two factors go together.

As the Rev. Fred. A. Hinckley has trenchantly put it, in his inimitable discourse on industrial equity, "Production must be better when all are good consumers. No demand of the King for shoes can be equal to what the demand of his thousands of bare-footed subjects ought to be. No demand for cotton cloth in our own land for the well-to-do, can be equal to what it would be if all were well-to-do. No monopoly of any article for which there is naturally general use, can ever conduce so largely to the profitable production of that article as would bringing it within the reach of all, or rather let me say, bringing all within the reach of it."

If I may be allowed to offer an opinion upon this question, among those expressed by so many learned and practical political economists, it is this: Let labor be turned in the direction of minor industries allied to agricultural pursuits in the vast unpopulated regions of our country and establish broader and more liberal commercial relations with the Latin-speaking people of Central and South America; bridge, as it were, the water separating the ports of the United States from those of our Central and South American cousins, with a merchant marine adequate to the occasion, and you will hear no more of over-production and under-consumption.

If there be a conflict between labor and capital it must arise from either an inability on the part of the laborer to meet his

living expenses in a comfortable manner on account of the over-weening desire to accumulate wealth on the part of the capitalist, or from a spirit akin to that on the part of the laborer. Their interests must be mutual, or reciprocal, or there can be no healthy industrial development.

Now let us see how this will work in its application to the issues of the day. Let us suppose that we introduce into the vast uncultivated regions of the Southern States, not restless strikers from the bloated manufactories of the Old World, or from our sister States of the North and Northwest, but thrifty, frugal, peace-loving, family-loving citizens, and their name is legion, who could find here room enough and to spare to follow agricultural and industrial pursuits in which they are so notably skillful.

Bring them here, I say. Let our lands be cultivated by them; let them rear sheep and cattle of every kind; let them plant their vineyards, orchards and gardens; let them establish their creameries and industrial shops and factories; let them flood the land with food and drink until every laborer can sit down after the toils of the day to a toothsome meal at half the price he now pays for his meager and unwholesome rations in the densely populated cities of the North, and, unless among the vicious and turbulent, you would hear no more of strikes. Crushing monopolies cannot live in these United States. There is no embargo laid upon a man's becoming rich—vastly rich—but there is a way to become so without grinding the faces of the poor. At the present prices paid for the staples of life, the laborer cannot afford to indulge in that character of food which is so necessary to his health and that of his family, and he cannot and will not go home and look into the wan and sunken faces of his wife and children without the spirit of rebellion against the fate which binds him hand and foot to the Jugger-naut car of stern monopoly.

And then, again, all these people will need the products of the great manufactories. They will need implements and machinery for their farms, utensils for their households, clothes for their families; the demand will be increased for industrial products, and in return will be furnished the necessities of life

from the field, the garden and the pasture, which will cheapen the cost of living and bring about a healthful balance of industrial development. This, to me, is the only solution of this problem, and I believe it thoroughly practical.

And now let me say, that it becomes every man who has the interest of his country at heart to study these great questions, which are of such vital interest to the prosperity of our land. We cannot afford to stand by in apathy.

The political economy of our country is of far more importance than its political government. The settlement of this question is of far greater significance than the election of a President. Any of us might be willing, and all of us think we are capable, of filling the office of the Chief Executive of the Nation, but who will be the Moses to lead us out of this economical wilderness? God send us soon the man.

At the conclusion of Major McWhirter's splendid address it was announced that a just completed census gave Knoxville a population of 30,008 souls.

UNIVERSITY FARM.

The report of O. P. Temple, Chairman of Agricultural Committee of the University, was next read and adopted. It was as follows, and explains itself:

I cheerfully comply with the resolution adopted by this Convention, requesting me, as Chairman of the College Farm Committee (called the Board of Control), to give such information as I can as to the work we are doing on the College Farm, and the more readily because I am not ashamed of our work.

A farm conducted with the funds of the people, and for their benefit, as a means of industrial education should combine to some extent the features of an experimental as well as those of a model farm. It should be wholly of neither kind. A State farm should be to a certain extent a model. It should be neat, clean, in a high state of fertility, and with everything on it suggestive of comfort, taste and thrift. And, yet, there should be nothing on it indicative of wastefulness, extravagance or mere show. In a word, while there should be apparent the

highest and best methods in everything, such a farm should combine the useful and the beautiful, the economical and the progressive in such just harmony as to bring it as a model for imitation within the means of the great body of farmers.

For the purpose of experiments, it should be conducted in such a way as to secure results of a practical character, which, when published, may be useful to the people of the State. These experiments should not be too costly nor too complicated for repetition by a farmer of ordinary means and intelligence. They should relate directly to farm operations or farm economy, such as crop-raising, stock-raising, dairying, fruit-raising and other special pursuits—all branches of farming.

These are what the University Farm should be, and these are the things, in brief, which we should do. Our farm, it is confessed, is not all it should be, for when it was purchased it was badly exhausted, and much of it abandoned. We are now engaged in trying to restore it to fertility. This must be done before any important results in raising crops can be accomplished. The area of good land has been so small, and the demand on it so great, that this work of restoration has been very slow. Still it goes on satisfactorily. We seek to secure this restoration to fertility by the use of all the manure we can make, by planting but little corn; by the rapid succession of clover crops, and by grasses, and by plowing under green crops.

It is only recently that we have adopted a regular system of experiments, in the use of green crops, as a means of restoring fertility to the soil. Last fall, with the approval of the Professor of Agriculture, I directed nine such experiments to be made. It is too early yet to speak of the results. They will be published from time to time as they are developed. These experiments run through periods ranging from one to six years, and some of them are on half acre plats, some on three acres, and some on fifteen acres. They are to be made with peas, rye, corn, millet and clover, each alone, and in some cases with alternate crops of peas and rye, with alternate crops of peas and millet, and with alternate crops of clover and peas, all plowed under while green; and also with alternate crops of clover and wheat, extending through six or more years. The

very thinnest, poorest land has been selected for these purposes, whenever practicable adjoining strips of land have been selected. When a sufficient amount of vegetable matter shall have accumulated in the soil by means of these green crops, lime will be applied on parts of the land, leaving part unlimed, so as to see its effect. This will be varied also, by sowing larger quantities on some parts than on others. What amount of good that these green crops will do the experiments alone can determine, but that they will be beneficial to some extent can scarcely admit of a doubt.

These experiments are all of a practical character, and cheap, and are such as any farmer can understand and imitate by the use of his own labor. We are also conducting a great many experiments, perhaps of a little more costly character, in the cultivation of wheat. These are such as experiments in early and late sowing, thin and thick sowing, in testing the different varieties, in the use of different kinds of commercial fertilizers, and in different quantities, in testing the value of manure when scattered on the surface as compared with that plowed under, and other similar experiments. The results of many such experiments heretofore made, have already been published from time to time. In this respect no agricultural college of the United States, so far as I know, has surpassed ours.

In corn we are making experiments in planting in wide and narrow rows, in thin and thick planting, in planting in hills and in drills, and with single stalks and double stalks, and in drills with narrow rows and single stalks wide apart, and wide rows single with stalks closer together. In Irish potatoes experiments are being made with large tubers and small ones, and in cut potatoes with single eyes and several eyes. I also directed an experiment to be made with straw in covering the rows with it several inches deep as soon as the potatoes are planted.

In keeping and fattening cattle we are conducting many experiments in the use of silage and the different kinds of grain. On the milk cows we are trying the effect of the use of silage alone, and also mixed with meal, in producing milk and butter, are compared with different kinds of meal.

Our college built the first silo, I believe, in Tennessee, and perhaps the first in the South. It was then an experiment, but no longer so. It has proved with us a great success. We have used two silos for five or six years, with a large saving of expense, and an improvement in our cattle. They eat it constantly from November until the middle of April, and they have invariably been healthy and done well. From six or eight acres of tolerable land, sown in corn and converted into silage, we have for the last two winters, carried from forty-five to fifty head of cattle through the entire winters, this, mixed with inferior hay, being at times their only feed, and at all times mainly so. Indeed, I do not doubt but what it alone is quite sufficient for all dry stock, as it has proved to be in hundreds of cases. There is no mystery about saving silage. It is as simple a process as saving hay. Nor is there any difficulty in the construction of a silo. I may further remark that it is generally believed that silage used in large quantities is not a safe feed for horses. We use it occasionally in small quantities for them.

Here I might stop, but I shall venture to say something as to the work of instruction in the University. For many years the course of instruction provided in the Agricultural College proper has been respectable, though not so varied and thorough as I have desired. The difficulty has been to induce young men to take that course. But few would do so. Even the sons of our best farmers, who are loudest in the praise of rural life and the dignity of labor, when they enter the University, in nine cases out of ten, shun the agricultural course. Their parents might control their choice, but they do not. Indeed, the very farmers who are loudest in their abuse of lawyers and other professions, act in reference to their sons as if they were ashamed of their own calling. And yet the University is constantly censured, often by these very men, for not doing more for the farmers.

I have thought for years that there was some cause for complaint on both sides. To remove this cause, so far as the University is concerned, by wider and more thorough instruction in the branches of learning related to agriculture and the me-

chanic arts, has been my effort for fifteen years. At last I am able to announce that, at a late meeting of the Trustees, courses of instruction were adopted which will effect a complete revolution in the University. In addition to the regular four years' course in agriculture and in the two years' course in the same, and the course of "agricultural apprenticeship" of two years, all of which have been heretofore mainly devoted to agricultural studies, directly or indirectly, and all of which have been widened and extended by the recent action of the Trustees. They have been introduced into all the other courses except engineering and applied chemistry—three studies directly related to agriculture. These alone, if carefully studied, are sufficient to give a student a tolerably scientific knowledge of agriculture. But in these courses he has to take, besides these, many other studies bearing on agriculture.

The result is that every student, whatever the course of study he or his parents may select, except engineering or applied chemistry, will, in passing through the University, encounter a sufficient amount of agricultural learning to give him a fair knowledge of the leading principles of that calling. He cannot evade it. Farmer's sons as well as other students, are compelled to study more or less agriculture. Even in the applied chemistry course the student will encounter several agricultural studies. If he should take the engineering course there he will meet mechanics and the work-shop. So at present there is no chance to escape entirely an industrial education in the University; and this is as it should be. As just intimated, we have also established a special course in the principles of mechanics, and make arrangements for practical instruction and practice in a work-shop.

At first this will necessarily be imperfect, but as we gain experience, and as soon as our means shall permit, we expect to enlarge the instruction, and the facilities for practical work, so as to make this a means of "industrial education" of equal importance with that provided for farmers, and so as to make the two emphatically what the law directs "the leading object" of the University. In agricultural studies, according to the new curriculum, I believe I can safely say, that we have provided for

instruction equal to that given in the most advanced agricultural colleges in the United States, and very much better than in a majority of them. We still retain Latin and Greek, as we are clearly authorized, if not required to do, under the act of Congress, provided they are not made the leading objects of instruction; but they are greatly curtailed. And even if a student should select either of the classical courses, he will encounter in them and be compelled to study of the principal agricultural subjects.

While, therefore, our University has taken these most important and advanced forward steps, we hope to do even more in the future. It takes time to effect great changes. It takes time and experience to find the right kind of teachers, who sympathize with and understand this "new education." It takes time to overcome the predilections of teachers in favor of the old and their prejudices against the new system.

It now remains to be seen how far the farmers will sustain and support, by their patronage and sympathy, this school endowed for their benefit, and hereafter to be conducted with special reference to the education of the "industrial classes." It also remains to be seen how far the people of the State, through the Legislature, will go in granting further aid, as nearly all the other States have done, to the mechanical department, in order to secure the full benefits of mechanical instruction, by means of amply equipped work-shops and adequate machinery.

As time goes on, as experience is gained, as the circle of knowledge is widened, new methods should be introduced and wider usefulness be attained. Old ideas must give way for newer and better ones. The fond clinging to old systems must and shall give way to progress and improvement. The old education, fitted and designed for the professional classes, must and shall give place to one intended "to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." All obstacles or persons in the way of the accomplishment of this great object should be, and must be put aside, brushed out of the way.

Col. J. B. Stokely moved that the report be cheerfully accepted, and the management of the institution be commended for their advanced steps taken by them in the matter of agricultural education.

After some appropriate discussion, the motion prevailed.

Col. C. W. Charlton, of Knox, offered the following, which was carried.

"Resolved by this Convention, That we recognize and appreciate the valuable services of Hon. A. J. McWhirter, Commissioner of Agriculture, Statistics, Mines and Immigration, which he has rendered all sections of Tennessee, and that we bid him Godspeed in his noble work."

Col. O. C. King, of Hamblen, offered the following, which was also adopted :

"Resolved, That this Convention of East Tennessee farmers desires to bear testimony to the unflagging zeal and intelligent efforts of Col. C. W. Charlton, the Assistant Commissioner of Agriculture, etc."

In the absence of Dr. N. T. Dulaney, of Sullivan County, Dr. A. A. Caldwell, of Jefferson County, was called upon and read the following essay :

HAS FARMING IN EAST TENNESSEE KEPT PACE WITH OTHER INDUSTRIES ?

Farming had not kept its proper place with other industries. He had attended the meetings of this Convention since its first, eleven years ago, and had never been here that the old aphorism of the "man who makes two blades of grass grow," etc., had not been repeated. But the most important matter is to get due pay for the one blade.

When we began first to assemble wheat was worth \$1.00 per bushel ; now it is worth 75 cents, which looks as if we were advancing backward.

Our millers go west and buy and transport wheat cheaper than we can grow it. We theorize and theorize, and waste much valuable time thus; but we want to be more practical.

We want some man, a good, kind friend, to tell us how most profitably to convert our produce into money. Farmers are cowards—afraid to invade the domain of politics. We should meet and discuss questions of practical politics, matters of daily concern to us, and our interests, and thwart, if possible, the evil tendencies of modern legislation.

There has been built up of recent years an incorporate monopoly by legislation that well-nigh controls everything, and if we as farmers do not assert our might and check such legislation we may content ourselves to be serfs and vassals the balance of our life.

It is not economic that the virgin West and her superior facilities and cheap and rapid transportation should be in a position to place our products in a position of unprofitable production.

Neither political party would do the farming interest justice, alike they beguile the farmer with glittering generalities. Their platforms, bereft of tergiversations, approximate the same end. Politics are a lie.

Mr. A. L. Griffith, of Marion—Politics are deceitful and contaminating. He had heard that we should introduce more farmers into Tennessee to make more produce when we cannot sell that which we have profitably.

Political economists tell us there is an over-production. There can be no such a thing so long as there is an empty stomach or poorly clad body. Strikes and tramps are everywhere. There is a fundamental wrong somewhere. To correct it should be the earnest and patriotic endeavor of every good citizen and especially law-makers. Let farmers organize and insist upon equitable legislation.

PISCICULTURE—BY J. H. PICKLE, OF MONROE.

The first thing to consider is the character of the pond. There are two kinds of ponds—natural and artificial. Under proper conditions an artificial pond has all preference. Well constructed you may control it and its finny inhabitants at will, which is necessary to success. Of course, you cannot do this

with natural ponds. You want a pond so arranged that you can flood or drain it off occasionally. Suppose you want to supply stock for foundation or for market, you can do it with all ease when your pond has proper drainage.

For spawning you must have a uniform temperature, and this alone can be secured by an artificial pond. This arrangement also allows you to rid your place of those great drawbacks to successful pisciculture, crawfish and muskrats.

The best depth is three feet and about four feet wide at the top. Clay and gravel make the best bottom. The mouth to the drainage outlet should be covered with wire.

As a start, get large fish, two or three years old, the latter best. He had never seen a small fish until breeders were three years old. With small fish you must wait a long time and incur many risks.

The worst enemies to fish are the common snapping turtle and blue crane. He has known the turtle to travel miles to hunt fish. Next comes the muskrat and crawfish and crab. I have never found a vestige of a fish in bull-frog. They, however, do a great service in a pond in the destruction of crabs.

The implements necessary to a pisciculturist are a wheelbarrow, pick, shovel, seine and shot-gun.

The German carp are decidedly the best fish for home growing.

Another thing to guard against in natural ponds is the pollution of them by stock, which detracts very much from their food qualities, and makes them unfit to eat.

The important question is, will it pay?

More money can be made on one acre of fish than on ten of corn or wheat or anything else.

You hear many fishy (?) stories as to the capacity of ponds. A good pond like a good pasture will support a given quantity of stock. Fish must be fed. A good-sized fish will eat from a half to a pint of corn per day. Corn is his standard food. It

costs about five cents per pound to raise fish, which readily sell for ten cents, and gives better profit than any other business in his knowledge.

It afforded the greatest pleasure and recreation in his knowledge. When tired and weary with the duties on the farm it is an exquisite treat to cast the line into a well filled pond and while an hour in this most charming pastime.

They do not destroy one another. But other fish should not be allowed among them. They (the carp) are great cowards, small branch minnows will chase them all over a pond.

At three years of age his fish weigh from eight to ten pounds. Eggs will hatch in from ten to twenty days, which time depends upon the temperature of the water. One large fish will deposit from 250,000 to 300,000 eggs per year.

Each female fish should have from three to five males with her during spawning season. Sexes can only be distinguished during spawning season.

They begin spawning about the middle of May and continue two months. If grass or some vegetation is in the pond to spawn upon it is much better, also shade.

Mr. Pickle illustrated his talks with some fine living specimens, one, two, three, four and five years of age. A vote of thanks was tendered Mr. Pickle for the information.

AFTERNOON SESSION.

At the assembling of the Afternoon Session, a short time was devoted to miscellaneous business, and among other things, J. V. Fulkerson, of Knox, offered the following, which was adopted:

“Resolved, That this Convention urges the Governor to use every means in his power, regardless of cost, to have the pleuro-pneumonia removed from the borders of our State.”

Some discussion was had on the question of Randall grass. Mr. Fulkerson, who has extensive knowledge on the subject,

pronounced it the best grass there is for grazing, but it is not a hay grass. It will only grow on suitable ground and the right location. The north hill-side is the place. It will not grow on south hill sides or on poor land.

J. P. K. Wallace offered the following, which, after some remarks, was adopted :

“*Resolved*, That this Convention appreciating the value and necessity of an organ, true and trusted, devoted to its interests, most heartily indorse the efforts of the *Spirit of the Farm*, Nashville, to build up and promote the agricultural interests of Tennessee, and commend it to the members of this Convention as worthy of patronage.”

The order of the hour, the election of officers, was then taken up, and Col. C. W. Charlton, of Knox, with some appropriate remarks, nominated Rev. C. B. Lord, of Blount, for President.

Mr. Henry, of Blount, seconded and indorsed the nomination.

J. V. Fulkerson, of Knox, nominated Hon. M. P. Jarnagin, of Jefferson.

Dr. J. C. Gillespie, of Knox, nominated George O. Cate, of James.

J. W. Andes, of Sevier, seconded Mr. Cate's nomination.

While the ballots were being prepared President Meek stated that some little necessary incidental expenses had been incurred in the Convention, and he called for small contributions. J. W. Andes, of Sevier, and Moses Smith, were delegated to take up the collection.

On motion J. W. Andes, of Sevier, and J. J. Burnett, of Cocke, H. L. Cate, of McMinn, and R. Goddard, of Blount, were appointed tellers to take up the vote.

The first ballot resulted as follows: Lord 58, Jarnagan 32, Cate 27, Stokely 2, Legg 1, Thomas 1, L. C. Houk 1, Loyd 1, whole number 138, necessary to a choice 67.

Col. J. B. Stokely wished to thank his friends for the complimentary vote and withdrew his name.

Dr. J. C. Gillespie withdrew the name of Mr. Cate.

The second ballot resulted as follows:

Jarnagan 74, Lord 60, Cate 2, Stokely 2, Jno. L. Grayson 1.

Judge M. P. Jarnagin, of Mossy Creek, having received the majority of the votes cast, was declared elected President of the Convention for the ensuing year.

Messrs. H. L. Cate, Jno. W. Andes and J. J. Burnett were appointed a committee and conducted Judge Jarnagin to the stand, which he took, accompanying his induction into office with a few appropriate remarks.

The election of a Secretary was next gone into, and, on motion of Col. J. B. Stokely, J. K. P. Wallace, of Anderson, was re-elected Secretary by acclamation.

Mr. Wallace accepted with thanks.

On motion of Mr. Wallace, T. J. Cate, of McMinn, was re-elected Assistant Secretary.

EDUCATION OF FARMERS' SONS AND DAUGHTERS—BY PROF. J. W. GLENN, UNIVERSITY OF TENNESSEE.

MR. PRESIDENT: The day is past when education is sought as an ornament, a kind of Sunday dress, too fine for every day use. We are now inclined to look at everything from the utilitarian standpoint. True, we should accept all results as paying which contribute to health, happiness and general improvement as well as those which bring money, meat and bread. To-day we are disposed to discuss education mainly as a factor in the production of material resources and the comforts of life. Ignorance is expensive anywhere, especially on the farm. It may be bliss sometimes, but it is a very costly luxury. Instance, the glass and crockery broken and the costly plants uprooted by ignorant servants; the loss of seed and labor, and sometimes the whole harvest is the price for ignorance.

Napoleon III. forgot the teachings of the "Little Corporal" and his legions went down before the educated armies of Germany.

More than all these are the enormous expenses of crime in our land. I have before me statistics carefully collected from

New York, Pennsylvania, New England and the Old World, and these figures exhibit a most impressive and instructive truth as to the relations of pauperism, crime and ignorance. The proportion of criminals who are illiterate is just about ten times as great as that from persons who can read and write, more than fifty times as great as that from highly educated people. The proportion of pauperism and beggary among the illiterate classes is even more overwhelming. A vast proportion of the expense incurred by society to protect the rights of property and a secure personal safety is a tax imposed by ignorance on skill and intelligence.

I am aware that such prominent writers as Allison, Herbert Spencer and Mr. Buckle have tried to make it appear from statistics, that "The amount of crime committed in a country is, year after year, reproduced with the most startling uniformity, although that country may advance in education." But these gentlemen do not call attention to the fact that detected crimes are the only ones reported in statistics, or that the means for detecting crimes increase at about the same rate as the advance of education; nor do they notice the fact that, as civilization advances, hundreds of acts are treated as crimes which before had been regarded as only venial offenses. So their statement can have little or no effect on the conclusions given above, which are made, not from general statistics, but from a direct comparison of ignorance and crime. The grand object of education is to economize time and labor. This above all things is now needed in developing agriculture. Loss from ignorance on the farm is something stupendous and far beyond calculation. The merchant can estimate his losses and gains approximately, but where is the farmer that can calculate the expenses of his last year's crop? We may approximate the costs of time and labor; who can estimate the plant food that was wasted, or the amount left in the soil? Who of us can tell how to feed a horse exactly right? Can you tell how much food an acre of corn will consume in one night? or how its food should be compounded and cooked? We know so little that we undervalue all education. We see so little of the exact results of mental work on the farm that we are apt to regard muscle as of more value than brain. What a mistake! Children living

in society may acquire culture, and culture may, in a measure, supply the place of education in schools. The farmer's children are very little in society; the school to them is everything of intellectual growth outside of themselves; they must be educated and cultured at school or not at all. Even the most intimate association with the best authors and a perfect acquaintance with the literature of the day can hardly give them the self-possession and quiet confidence which mark the true gentleman and lady in society. But to have no books, no school, no education and no society form a destitution that is truly pitiable; and this is the general condition of the farmer's children when uneducated. It is a loss of everything, and they frequently feel that the world and all nature are unfriendly to them.

First—They are almost sure to lose their self-confidence and self-esteem. They know that they are at a disadvantage and they are in constant dread of criticism and imposition. There is no more pitiable or more pathetic object than an ignorant country boy taking his first dinner among "the quality." While his sister may pass such a crisis more easily and more quietly, she suffers much more excruciatingly. Such a boy will shun the city school, and even in his old age he will not attend the city church. His unfortunate position and his failure to secure an education often make him an Ishmaelite. He regards every man either as an enemy or as a robber ready to take advantage of him. In such a situation it is hardly possible to retain manhood, and if manhood be lost, what gain in life can be worth anything?

Second—If farmers' children be not educated, they must forfeit society to a very large extent. They will not be inclined to seek society, nor will society seek them. They can find no solace in books as the learned hermits do, hence their pleasures in life must be limited to very narrow spheres.

Third—There can be no hope of exercising extensive influence or wielding great power in politics or society. Some exceptions have occurred in the earlier days of our Republic among young men having very extraordinary talents, but in

these days all the chances are against a man or woman leading in society if raised on a farm and without education. Such a position seems to me hopeless. The merchant, the lawyer and all professionals, being constantly in society, if they can start their business at all, without education may grow in mind by constant association with others. They may become cultured and educated. Even the mechanic and most craftsmen enjoy more of the advantages of society than farmers or farmers' children, and they may acquire much intelligence without books. But what hope is there for man or woman cut off from general society to a large extent, as the farmers' family must be, and yet having no capacity to associate with the great minds of the past and present, whose lives and thoughts have been preserved in the pages of books. These last are the best associates, but they must be known intimately, and studied carefully, or they cannot qualify the student to lead and control men. Successful politicians and social leaders see a great deal of public life, and consequently study human nature in living subjects. The farmer must, to a large extent, study men in books. If he has not these books and cannot read them, what hope is there for him of political preferment or large social influence? He will not be chosen to represent men in law-making assemblies nor in executive offices; and if he were selected for such positions he could not discharge the duties without education and culture far superior to that which most of them have.

A large proportion of our best farmers will not now consent to become candidates for office from the general impression, accepted too hastily, that farmers, as a rule, are not qualified to hold office of any kind. In fact, there has been a too general assent to this idea, and there are hundreds of farmers in our State who might represent us more faithfully and with more ability than many politicians and professionals, whose qualifications are never questioned, but which ought to be more closely examined than they now are. We can never elevate and popularize the farmer's vocation until we educate, not only their children, but the farmers themselves and their wives, and open a broad avenue through the farm to wealth, to fame, and to power.

Fourth—Ignorance on the farm is a loss of almost all the physical powers. Man was endowed with a very large mental organization, that he might think for the lower animals and control the blind forces of nature. If he had been intended for physical labor alone, he would have been given the strength of the elephant, with the activity of the antelope. He was told to subdue the earth; that must be done by thought, and done on the farm where the curse was placed. Ignorance has made him a slave—a galley slave—to his necessities, and for a long time crushed him with a superstitious dread of every exhibition of power in heaven or on earth. Instead of making the lightnings his swift messengers, he fled in terror from their glare and sought in every way to propitiate the “god of thunders.” The fires and floods filled him with awe and dread, and for centuries he never dreamed that such powers could be made subservient to his will. Man seemed to think that these physical forces and all immaterial agents belonged to the gods, and that it would be sacrilege for him to put his hands upon them or seek to change them.

He might dream and theorize and write his poetry about the storms; but he feared the vengeance of Æolus if he should make the least effort to bind the winds; he who would attempt to chain the lightnings would at once be blasted by a thunderbolt from Jove. Hence, men have gone on thinking the grandest of thoughts, but working like pigmies. They have dreamed of Utopia, but lived in anarchy and bloodshed. Fancy gave wings to Dædalus three thousand years ago, yet the pratical balloon is still a thing of the future.

No place, not even the work-shop, opens a grander field for subjugating and applying the forces of nature than can be found on every farm. In no arena of human action can there be found grander subjects for investigation, or problems which, if solved, would give more valuable results to the human family. Hardly any situation brings man so constantly face to face with the phenomena of nature, or places him more frequently in direct conflict with the physical forces. In such a position we need the strongest intellects trained to the highest degree of perfection.

We repeat, man was made to think, to plan ; nature supplies him with abundance of power if he will only direct the forces aright.

Educate the farmers' children ? Where are the highest efforts of trained thought required if not here ?

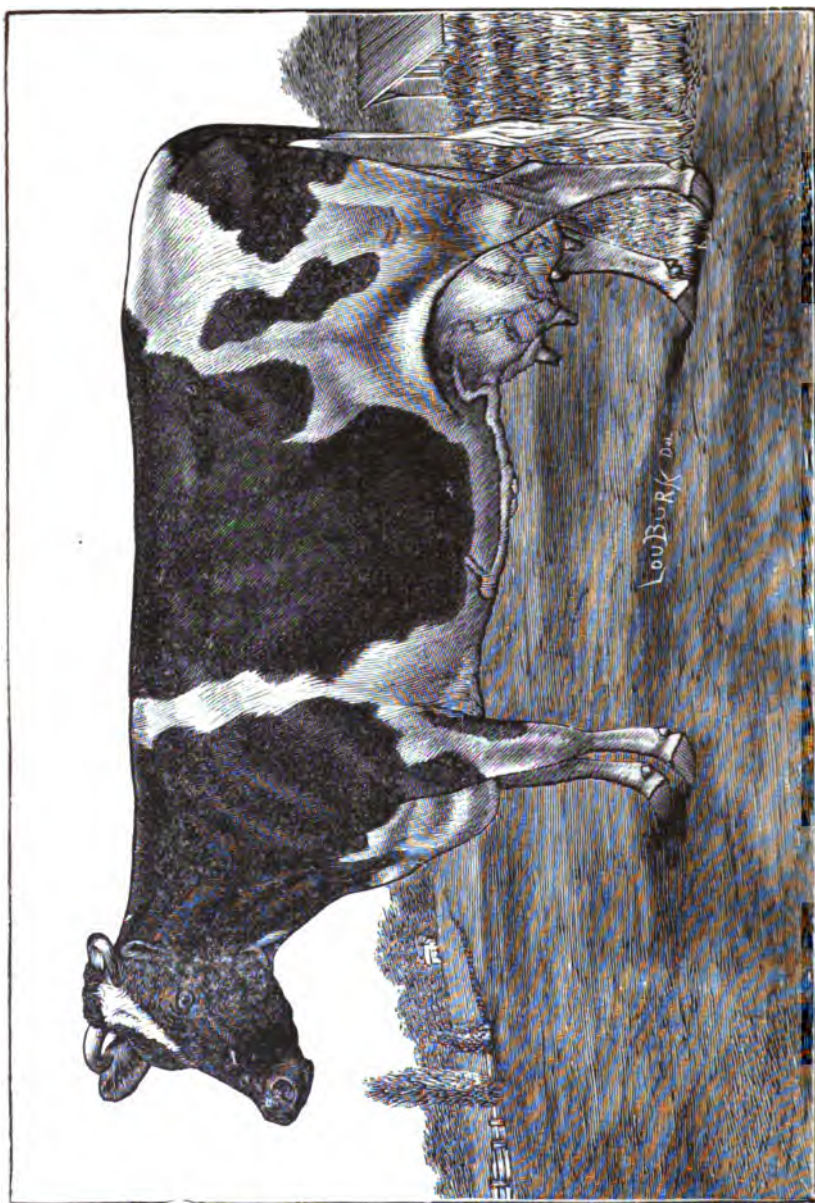
The laws of commerce are comparatively simple, and even the problems of social government have been solved with moderate approximation of truth ; but who, yet, has unraveled the mystery of life—the life of even the simplest flower ? Who has looked into the secret of plant food, or has discovered how the grass grows ? Who has traced the path of the cloud or wrestled successfully with the raging storm ? We have, generally, regarded the farm as the arena for the display of muscle, when the Creator, no doubt, intended that there should be the grandest exhibitions of human thought. There are her huge engines driven by water or by vapor, by attractions and repulsions, by light, heat and electricity, and above all, by the forces of life ; and they need but the hand of man placed on the throttle to move and throb at his will, subject to his high behests, bringing comforts to his home and filling his coffers with treasure. Is not this an effective call for education for the farmer's boy and girl ? Manhood and womanhood on the farm demand it. Nature has placed there the profoundest problems for solution. The farmers' sons and daughters, if properly educated, would remain by the old homes. Prepare them and furnish them with the appliances to study the mysteries and understand the beauties about them, and you will plant them where their parents lived. Uncover to them the principles of chemistry that they may know what constitutes the bricks in the building of vegetable and animal fabrics. Teach them the botany and thus place in their hands the keys which will unlock the secret chambers of life around them and reveal to them the processes by which the trees are built and the delicate fabric of the flowers is constructed. You will open to them a world of wonders so charming and attractive that they can hardly be drawn from it by the allurements of society. Invite them to nature's menagerie, as exhibited in the books of natural history, where may be seen wonders more astounding than

appear on the illuminated bills which advertise the circus. Let the entomologist, with his microscope, introduce them to the home of the provident ant and the industrious bee. Let them watch the former while they drill their soldiers, milk their cows, and stow away their living jars of sweetmeats, and study the latter while they, with a science more profound than human wisdom and a skill superior to that of the most learned alchemist, make queens and drones and neuters as they choose. Place in their hands some book, which will reveal the wonderful workings of Nature in her largest laboratory—the farm—to supply all living creatures with food, and you will have not only contented and prosperous people on the farms, but you will have also workers, who will one day place the world far in advance of the greatest achievements witnessed by Bulwer in his dreams of the “Coming Race.”

I repeat that man was placed on this earth to subdue it by thought. The great battle of Armageddon must be fought on the farm. There the bramble and the curse were placed. If victory comes all avocations will share the glory. Arm the boys and girls for the great battle on the farm.

There the forces of nature are strongest and most rebellious, and have been, to this time, least under control. Educate the farmer's boys and girls in preference to all others, for they above all others need it. Prepare them for this contest with nature. Prepare them to be leaders in society, and encourage them to form a variety of associations. Prepare the boys to be legislators and the girls to be intelligent workers in the church, and all eleemosynary associations, and the year 1920 will find us as far in advance of our present position as we have progressed in the nineteenth century.

I believe it should be required in all of our country schools, not only that the principles of agriculture should be taught, but that every child should have some insight into chemistry and botany, entomology and other branches of natural history, so they may have some intelligent conception of how nature's wonders are performed. These will raise in young minds an insatiable desire for more extended knowledge and arouse ambitions to cope with the forces of nature and to be leaders among



Imported Cow JANNEX WORTEL—Property of EUGENE SMITH, Nashville, Tenn.

Butter test of 18 lbs. 8 oz. in seven days.

men. It will give us a class of naturalists who study nature at home, and scientists who seek knowledge in her laboratories, artisans who will rebuild the walls of paradise, workmen who will exterminate the brambles and thistle—a rejuvenated humanity no longer “earning its bread by the sweat of its brow,” but who sits in the shade and by the movement of the hand or the touch of a button, sends the vapors to revive the thirsting corn, and the breezes to kiss the roses into beauty—light, heat and electricity spending on various missions to call up plenty and prosperity to bless a happy land.

Mr. Campbell, of Knox—Tennessee has an average of about \$2.50 per capita to each scholar, and with that amount it is impossible to properly educate the children. Let us take hold of the subject and press it hard, and get higher and higher in the scale of general education. Vote only for men who will demand our educational rights.

Dr. Bond—The great trouble with the country, is incompetent teachers and scant funds.

Mr. Griffith, of Marion—Teachers are not sufficiently qualified, and sufficient inducement is not given the better class of teachers.

“How to Bring Up a Worn-out Farm” was opened by A. L. Griffith, of Marion County. He had once come into possession of a worn-out farm. First broke up the land thoroughly, then went into the woods near by and made collections of leaves, decaying wood, etc., and with all the stable manure he could manufacture applied to his soil. But finding this insufficient he resorted to green manuring: sowed field peas, turned them under green; but the growth was scant the first year, followed the same course the next year, and the next spring sowed clover and grass. That was in 1872 and in an old apple orchard. He had not cultivated that land since. His fruit trees appeared to take on new life and vigor. Increased his supply of feed by going into a grass lot in the woods from which he made a fine lot of stable manure. Grow peas and oats and you get an immense lot of well distributed fertilizer, which plowed under affords the most ready and cheap method of reclaiming exhausted

lands. A neighbor had taken a piece of poor land, that was almost worthless, and by this method had improved his land so as to get forty bushels of corn and twenty of wheat per acre.

Mr. Cate, of James—We should not let our lands get poor. But he had come into possession of a poor piece of land adjoining his place. His first effort at improvement was with turf oats, which, when well grown was turned under, following next year with peas and subsequently with clover. That was fifteen or sixteen years ago, and the result is visible without any further fertilization.

“Should farmers continue to raise as much stock and produce as formerly, regardless of low prices?” By P. M. Widener, of Union County.

Farmers should raise more grain, but should reduce the area, and raise the best grade possible, and substitute grass and thus increase the producing capacity of the land by better rotation and tillage.

It is cheaper to grow 350 bushels of corn from six acres of good land than from twelve acres of poor land. The extra labor required for the twelve acres would improve the six acres, so that the cost per bushel would be less, to say nothing of the good results to follow.

I am in favor of raising more stock and of better grades. There need be no hard times for East Tennessee stock-raisers. On my way to this meeting I saw men from Virginia scouring the country in search of young cattle. Stock bring a good price. Cattle and mules are higher than at this time last year. Our herds of thoroughbred stock meet an active demand from buyers South and West. Our enterprising stock dealers readily find new markets. The West and Southwest are rapidly filling up with a people whose demands require good stock and if we will only give this branch of farming due attention we can supply all demands. But we must build up and not downward—must be more careful and systematic in our breeding. Good breeds, good attention and good feed would assure to East Tennessee blessings manifold, and a degree of prosperity not now dreamed of.

Colonel Meek—This is a question of economic farming. The people of East Tennessee do not have enough stock to properly supply increasing home demands.

The farmer with stock to sell "is in the chute" and knows no hard times. We cannot successfully compete with the great Northwest in growing wheat and corn. But we can grow stock so cheaply that we cannot fail to make money. We are assured all the elements of profitable stock growing in our facility for growing grass, and that will make cattle.

Jonas Irish, of Knox—No section of country he had ever seen could compare with East Tennessee for raising grass. A few years ago he bought some two-year-old heifers; kept two years and bred them, and sold as milk cows, for \$35 and \$40.

J. W. Fulkerson, of Knox—The great misfortune with East Tennessee farmers is they are content with too low a grade of stock and completely indifferent as to improvement. We must breed up. If you will do so you are sure enough on the road to success and prosperity. He is a skillful breeder of Jersey cattle, and finds a good demand, continually expanding, having demands all the way from Mexico. Don't stop until you find a male of better breed than your female. Not long since he took a high-bred mare fifteen miles to a stallion.

David Richards, of Knox—I am not a farmer nor delegate, but I have traveled and observed a great deal, and the farmers of East Tennessee have the easiest time of any people in the world. By a proper application to business they may have the finest country in the world.

T. R. C. Campbell, of Knox—East Tennessee is retrograding. Corn is worth from 42 to 45 cents per bushel and wheat 75, and we cannot grow these for this price profitably. We should change so as to raise more per acre and at less expense.

NIGHT SESSION.

LIFE AND HABITS OF INSECTS—BY PROF. E. W. DORAN, OF LOUDON.

A. L. Griffith, of Marion, said he wanted to relate an experience. He shot a partridge, cut open its craw and there he found twenty-seven bugs, two worms, one faulty berry and a sprig of grass. He never killed another partridge.

In reply to a question as to whether the crow is a benefit or an evil, Professor Doran said it is a mooted question, but he believed the crow does as much good as harm.

J. K. P. Wallace said the crow robs birds' nests, and thus works an injury in the destruction of our birds.

Col. John M. Meek, speaking of the crow, pronounced him a bad fellow and ought to be killed. He carried off his wife's chickens. Colonel Meek had attempted, with a double-barreled shot-gun, but had never killed one yet. Save the partridge and other good birds, though. He said we ought to have a peremptory law to protect our birds.

A. L. Griffith said make it a penitentiary offense.

Colonel Meek said he was willing, the law would never get him.

Dr. J. A. Bond offered a word for the crow. They saved a field of wheat for him by taking up grub-worms from the roots, and not disturbing the wheat. It is not the common crow, but a kind of a raven that steals the chickens and eggs. As to the destruction of potato-bugs and flea-bugs, he had used slacked lime with success.

Maj. A. J. McWhirter asked how about the English sparrow?

Professor Doran—They are an unmitigated nuisance, and should be killed.

Major McWhirter said he had urged upon the Legislature the necessity of establishing an entomological branch in the Agricultural Bureau, and he considers it the most important branch of the department. But the efforts were to no effect.

Hon. O. P. Temple wished to defend the English sparrow. He had watched the birds in his yard catching worms and insects, and pronounced the reports about them slanders.

T. R. C. Campbell ridiculed the idea of a lot of men here trying to legislate against birds and bugs. Some men steal, but for that reason would you kill all men? Just kill the mean birds and let the others go. The crow, he regarded as his best friend.

J. K. P. Wallace offered the following, which was adopted:

Inasmuch as we hear of the widespread destruction caused by injurious insects on every hand,

“Resolved, That it is the sense of this Convention that an appropriation be made by the Legislature to employ an entomologist for all the time. And we do most respectfully call the attention of our next General Assembly to this subject.”

Mr. Lawrence, of Blount, said the worst enemy we have is the hawk and owl. Small premiums should be offered for their scalps.

A. L. Griffith said two of our best friends have been omitted. That is the black snake and the frog. He caught every black snake he found and carried it to his farm. One of them put in his crib would clean out all the rats.

J. H. Pickle said we want the birds to do what we ought to do ourselves. The best way to destroy insects is to take them in our fingers and kill them. Don't call on the Legislature to legislate against the bugs and birds.

Professor Doran called for all persons finding any new destructive insects to forward them to him at Loudon, and he would investigate and find a remedy.

Hon. S. A. Rodgers, of London, made some sensible remarks on this important subject, urging legislative provision. He wished also to add his testimony to the English sparrow nuisance.

Col. J. B. Stokely offered the following:

“Resolved, That the thanks of this Convention are extended to its officers for their efficient and zealous labors the past year.

To the press of the city and State for uniform kindness and full reports of the proceedings. To Major McWhirter for his interest and substantial aid in publishing and promoting the great interest sought to be accomplished by this Convention. To Senator Harris and Secretary Manning for their kind offers in procuring and granting the use of this splendid place of meeting."

Amended by Mr. Remine to include the railroads and hotels for reduced rates, and carried.

Commissioner McWhirter read a letter from the Spanish consul on the Spanish jacks, it being his desire to import some improved stock of that kind for Tennessee.

Rev. J. J. Burnett made a report of the committee's visit to the college farm.

The business before the Convention being concluded, a final adjournment was had at 10 o'clock p. m.

VICE-PRESIDENTS.

Following are the Vice-Presidents appointed for the ensuing year:

Anderson—John G. Hall, Budd.
Bledsoe—William Pope, Pikeville.
Blount—C. B. Lord, Bank.
Bradley—Gus. Cate, Cleveland.
Campbell—Alex. Lloyd, Jacksboro.
Carter—Joe J. McCorkle, Elizabethton.
Claiborne—E. P. Cawood, Tazewell.
Cocke—Dr. B. F. Bell, Parrottsville.
Greene—R. M. Alexander, Greeneville.
Grainger—Frank Nance, YZ.
Hancock—A. J. Tyler, Sneedville.
Hamblen—C. V. Taylor, Russellville.
Hamilton—S. A. J. Frazier, Chattanooga.
Hawkins—J. W. Rogan, Rogersville.
James—George O. Cate, Ooltewah.
Jefferson—J. J. Hubbard, Mossy Creek.
Knox—J. V. Fulkerson, Ebenezer.

Loudon—J. H. Johnson, Loudon.
 Marion—A. L. Griffith, Jasper.
 McMinn—John C. Cate, Mouse Creek.
 Meigs—W. B. Brown, Georgetown.
 Monroe—J. H. Pickle, Sweetwater.
 Morgan—M. Stephens, Wartburg.
 Polk—Mike Boyd, Benton.
 Rhea—B. M. Ewing, Carp.
 Roane—C. N. Martin, Kingston.
 Sevier—J. W. Andes, Sevierville.
 Sequatchie—Rev. John Alley, Dunlap.
 Sullivan—J. F. Massengill, Union.
 Union—S. J. Ledgerwood, Raccon Valley.
 Unicoi—George Swadley.
 Washington—A. S. N. Dobson, Jonesboro.

COMMITTEES.

The following Standing Committees were also appointed :

On Programme—J. B. Stokely, of Jefferson ; A. S. N. Dobson, of Washington ; H. L. Cate, of McMinn.

General State of Agriculture—J. A. Goddard, of Blount ; J. V. Fulkerson, of Knox ; J. F. Massengill, of Sullivan.

Immigration—C. W. Charlton, of Knox ; W. B. Brown, of Meigs ; W. Y. C. Hannum, of Blount.

Manufactures—O. P. Temple, of Knox ; H. H. Hubbard, of Jefferson ; B. F. Bell, of Cooke.

Quarries and Lumber—J. W. Glenn, of Knox ; Allen Stokely, of Cocke ; O. C. King, of Hamblen.

New Business—J. J. Hubbard, of Jefferson ; J. M. Heiskell, of Monroe ; G. H. Strong, of Knox.

Arrangements—W. R. Murphy, Rev. Isaac Emory, C. W. Charlton, of Knox.

Fairs and Farms—John M. Meek, of Jefferson ; J. J. McCorkle, of Carter ; J. B. Stokely, of Jefferson ; E. F. Sharpe, of Meigs ; C. W. Charlton, of Knox.

PROCEEDINGS

OF THE

Interstate Agricultural and Industrial

CONVENTION,

HELD AT

Jackson, Tenn., February 24, 25 and 26,

1886.

PROCEEDINGS.

Of the Northern gentlemen who co-operated with Commissioner McWhirter and Colonel Gates, perhaps none rendered more important aid than Capt. John F. Merry, the efficient General Western Passenger Agent of the Illinois Central Railroad, whose home is at Manchester, Iowa. His position and influence enabled him to contribute very largely to the good of the convention, and if the good will of the people is worth anything to a railroad company, and we think it is, the Illinois Central will not lose anything by the liberal course it has pursued in dealing with those who are working for the advancement of the South.

Under the clever and genial management of Captain Merry, the Illinois Central has been, and still is, an agent of the greatest good to West Tennessee. Reducing excursion rates to one cent a mile over all the roads he could influence, Captain Merry's enterprise has induced (as we have it from his own lips) 2,500 of the best immigrants to make their homes in this section of the State, escaping the bleaker regions of the Northwest to these more genial skies and to lands much cheaper in price and equally fertile with those they left behind them. We candidly admit, what would be folly to deny, that the road itself, aiding to build up the business enterprises of, and working in sympathy with, the communities which sustain it, receives tenfold of substantial recompense.

Jackson, Tenn., where this Convention was held, is a very beautiful city of some ten thousand population. It is an important point on the Illinois Central Railroad on account of its geographical location, its important manufacturing interests and the rich agricultural region by which it is surrounded. Jackson has probably the best system of public schools of any Southern city, and a visit to them by the Northern delegates to

the Convention, which was highly enjoyed by all, convinced them that they were schools that any Northern city would be proud of. One noticeable fact was that the scholars in the colored schools have precisely the same advantages and pursue the same studies as the white scholars.

But the glory of Jackson, in the opinion of those Northern people who were so fortunate as to be there, is in its people.

The opening of the Convention occurred Wednesday, February 24, 1886. There was a large gathering present, of delegates from every important agricultural district in the Union, and a goodly number of attentive listeners.

After Colonel Gates had called the meeting to order, the following address of welcome was delivered by Hon. A. J. McWhirter, Commissioner of Agriculture, Statistics, Mines and Immigration, of Tennessee:

We esteem it no less a pleasing privilege than a distinguished honor, to extend to the delegates of this Convention a most cordial welcome. You have been invited here to measure lances in this "tournament of ideas" in behalf of the arts of peace, to enlighten us upon the subject of agricultural development and industrial skill.

We are honored on this occasion with representatives from eleven States of this great Mississippi Valley. (I regret that all Southern States are not represented.) Men distinguished in agricultural, industrial and in professional pursuits. Many of them of national renown for ability, enterprise and achievement, who have for a while renounced the allurements of delightful homes, and the blandishment of kind friends that they may receive the welcome and enjoy the hospitality of Tennesseans. May we not express the hope that as a congress for the discussion of principles and policies that affect the social welfare, or as a conference for the exchange of experiences and comparison of methods in the interest of an elevated agriculture, and industrial skill that its effects will indeed be far-reaching and its influences incalculable?

Perhaps no State in the Union can offer a broader sphere for agricultural development and industrial skill than the State to

which we invite you to-day. Her minerals, her structural material and her forests are exhaustless. Her soil is rich and fertile and versatile. Her climate meets the wants of both the Northerner and the Southerner. Her winters are rarely rigorous and her summers always salubrious. The products of the North and those of the South meet within her borders. Her educational facilities have given her fame at home and abroad, and the tone of her people is commensurate with the highest culture of the world.

We again extend to you, gentlemen, a most cordial welcome, not only to the soil of Tennessee, but also to our homes and hearts.

THE CHAIRMAN.

The Convention then proceeded to pay a high compliment to the State of Wisconsin by electing the Hon. N. D. Fratt to preside over its deliberation. Mr. Fratt is a leading representative of the Agricultural interests in the Northwest, having been repeatedly chosen President of the Wisconsin State Board of Agriculture.

Upon being led to the chair Mr. Fratt responded as follows :

GENTLEMEN OF THE CONVENTION: In selecting me to preside over the deliberations of this Interstate Agricultural and Industrial Convention, you have conferred upon me a very high honor; an honor, not only to myself, but to the great State of Wisconsin, which I, as one of its delegates, have the honor to represent; that you should consider me worthy of such a testimonial of regard and esteem is a compliment wholly unexpected. I do assure you that the feeling that prompted it is most thoroughly appreciated and returned, for which I thank you most cordially. It shall be my earnest desire and purpose to so preside over your deliberations that none will have cause to complain of partiality or injustice. That I may do all in my power to accomplish this end, yet without your co-operation and assistance the desired result cannot be obtained.

Gentlemen, we have assembled here to-day from over a dozen States in the Union, and from nearly all of those mainly de-

voted to agriculture, the ablest and best farmers in the country. Men renowned in stock raising, in dairying, in science, in journalism, in statesmanship, and political economy. There are probably conflicting views on some subjects entertained by different persons present, it is both reasonable and right that there should be. Each member has the right to express his sentiments freely, and should be heard. Let the will of the majority be acquiesced in and accepted in good faith and fellowship, and harmony, and good feeling will rule the hour.

These Interstate Conventions will have a tendency to change the ruinous slipshod system of farming in the South altogether. The men who attend these Conventions cannot return to their homes without carrying with them new ideas, and knowledge of facts which will amply repay them for all the time and money spent.

Nature, it has been said, is exacting in her economy, nothing is wasted, but something added for her future supply of vegetation instead of this skinning process which has been carried on for years. A system of rotation of crops must be adapted, clover, more clover, and clover plowed under, this will prevent this continuous washing of the soil. This will lead to grazing, and grazing will lead to dairying and stock growing, which is the "alpha and omega," of all successful agriculture.

The good time for which we have all been praying, is near at hand. The South has been benefited by a large cotton crop, and is feeling in many directions the stimulus of the investment of Northern capital in a variety of industrial enterprises. The manufacturers are enjoying the benefit of large orders, and rising prices; are anticipating a year of unusual prosperity in 1886.

In conclusion let me say, there is no class of people under the sun who ought to be more prosperous than the farmers of the South, with a climate unsurpassed. To those who are industrious and patient, though of small means, Tennessee offers superior advantages for securing homes, and our home owners are our best citizens. A land of true homes, some one has said, is a land of true greatness. Therefore, let us all strive to pos-

sess ourselves of a home for our own sake, for our family's sake, and for the sake of our country. Gentlemen, again, I thank you.

OTHER OFFICERS.

The Vice-Presidents of the Convention were next selected as follows :

Col. R. P. McGlincy, of Illinois ; Hon. Clinton Babbitt, of Wisconsin ; J. P. Steele, of Iowa ; G. G. Dibrell, of Tennessee ; J. B. Crawford, of Nebraska ; J. H. Field, of Mississippi ; F. D. Holmes, of Minnesota, and W. H. Harris of Louisiana.

R. W. Haynes, of Tennessee ; S. D. Thompson, of Illinois, and J. B. Satterlee, of Iowa, were the Secretaries.

One of the first speeches at the Convention was delivered by the Hon. J. H. Field, of Columbus, Mississippi.

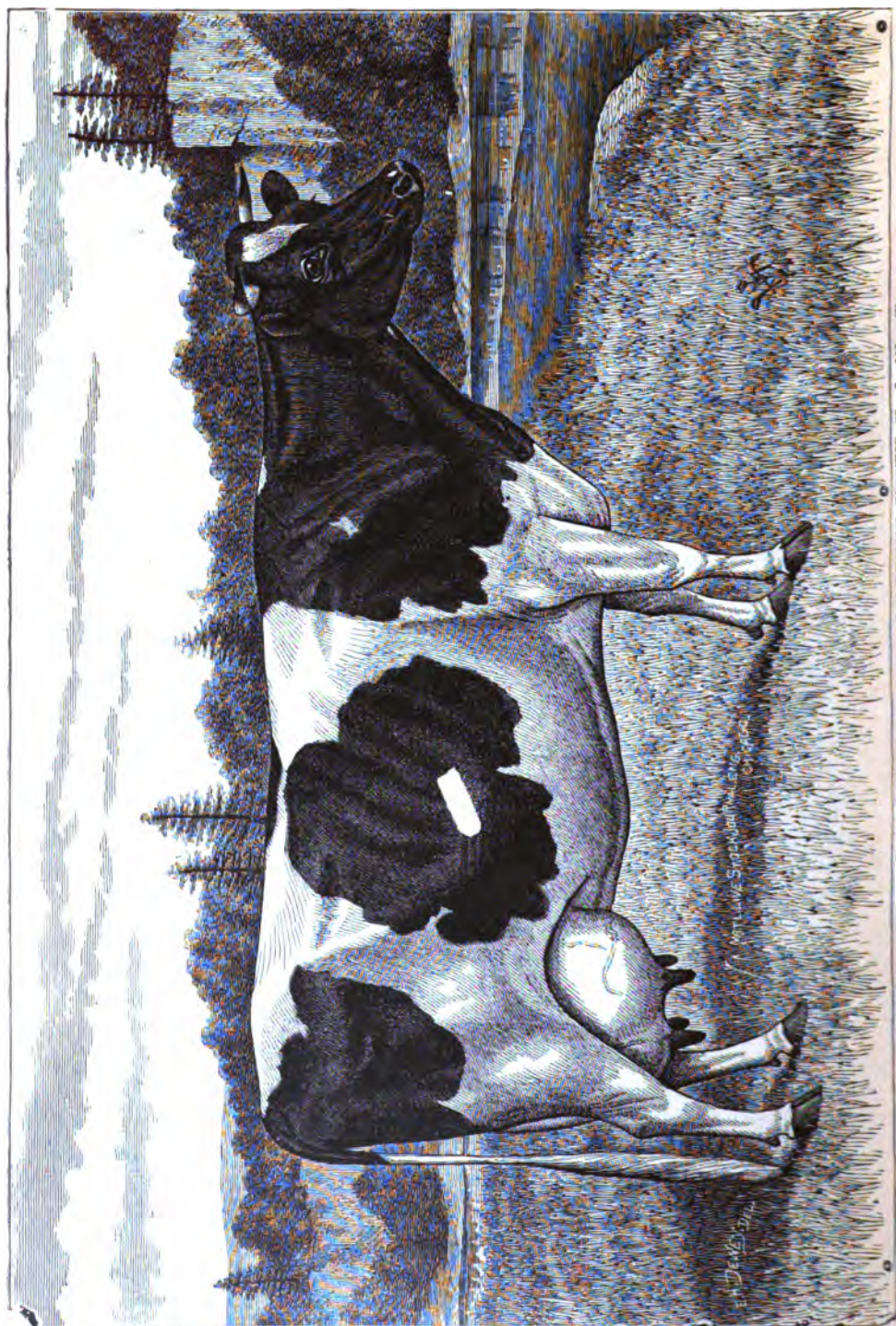
ADDRESS.

PROGRESS, PRODUCTION AND REFORMATION IN TRANSPORTATION,
INDUSTRY, MONEY AND LABOR.

BY J. H. FIELD, COLUMBUS, MISS.

This being a Convention looking in its aims and objects to agricultural, land and industrial interests generally, it is proper that what we say should have reference in particular to the matters and subjects that invite us together. It is a very broad field of view in this country, and over it we see a variety and multiplicity of products, making in the aggregate manifold interests and a bulk of business that sets the affairs of a nation in motion. Incidentally we have that grand make-up which we call progress, and also the civilization which is the pride and

boast of a land teeming with those forces which intermix and transmute energies into the flower and fruitage of prosperity and high hopes. With a soil fertile, and vigorous arms to till it; with educated labor and improved methods accumulating the supplies that bounteous nature yields to manly effort; the magnitude of landed interests; the industrial impulse expanding the heart with steam-power, it is well that those in interest should assemble in council and place well-directed thoughts in the lead of enterprise, and give the sanction of authority to well-matured ideas; to establish a school of recognized powers where representatives can deliberate for the the common good. Here delegates can be instructed and may acquire valuable information relating to all the products of the soil, taking into consideration climate, geology, chemistry, improvement in seed, how to modify plant life—in a word, carry the school into the vegetable kingdom. Here, too, we can follow the effects of all these on animal life, and listen to the poetry of science tell of the wine-press of the heart thrilling the veins with red, rich juices, converted from vegetable life, rearing structures high-bred in the animal royalty. We may see *here* the stately and courtly old warrior (Jackson) interesting his declining years with the poet idea, transforming *that* kingly animal so that the “speed of thought were in his limbs.” Here, too, the learned professors will carry us to heights loftier and sublimer than elsewhere, for nature’s verdure, her scenery, her lessons and her creations are viewed from the pinnacle. Each and every section will come with the specialty of its geographical position, and exchange thoughts across the border, unifying mind with the interflowing pulses that belong to kindred interests. All this is well, and still we may glean more. We may learn of perfection in machinery applied to agriculture; may learn of diseases in plants and the means of their prevention, insecticides that will remove a great scourge. All these things are calculated to improve our knowledge and favor our success; good seasons may prevail, healthy and abundant crops grow; the cattle market be replete with rich yield; the signal stations wave flags in reach of every farm; the pleuro-pneumonia be stamped out; the Commissioner of Agriculture may dawn as a new star in the Cabinet—all may go well with us, and still



COUNTRESS OF FLANDERS III.—Property of EUGENE SMITH, Nashville, Tenn.

storms gather in unlooked for parts of the sky. Indeed, we have been so busy with our home employments that we have not sought to draw the electricity from the clouds portending the greater harm. Our troubles do not come from failures in crops, when the shortage is general, for prices are then stimulated. Cultivation is a success, for this has been our study over the years. What about over-production following our enlightened progress in all the arts of cultivation? This is not immediately a pressing question, but I trust we may hear in the future wise suggestions from practical and comprehensive thinkers as to a policy that may regulate the yield. Certainly it cannot and ought not to be attempted to be forced by legislation. In the course of this address I can hope to do no more than to offer an humble thought in passing this subject in connection with other matters of concern. I trust I will be pardoned if I talk of the seemingly more remote things bearing on the subjects for our consideration, but which really affect our interests more than the seasons, the worms, the insects, the blight, the pleuro-pneumonia, etc. It must be remembered, however, that there is much force used to keep us on our private domain in the handling of subjects where other interests are involved. The day is at hand, however, when the limitations should be extended into the realm where other business interests should be invaded, at least to that extent that they become not harmful agents, but led to become beneficiaries of our particular industry.

The element of danger greatest in our front is the speculative spirit so rife with a class who seek to handle the products of the industries of others, inducing an unstable condition of the markets, not the result of natural laws but caused by the fictions in the brains of the "bulls and the bears." It will never be possible to prevent speculation, but the moral status of fixed facts made recognizable to all, in the data that go to form public opinions and estimates will go far to eliminate the *probabilities* that constitute the allurements of chance. A bureau of correct and well authenticated statistics under the supervision of a chief, whose station is invested with the dignity and moral power of rank, will subdue the excesses which so far wavers and unbalances the markets in prices.

To crown agriculture and its relative industries with this achievement would be to exalt and dignify, to systematize and direct—to give character, plan and purpose—to invigorate, not only the body of manual industry, but would impart a tone to mind that would dress the toiler in a new garb and touch the landscape with new colors. The embellishments of awakened art would thrill with its beauty, and the home of the farmer would be the beacon light, charming the weary to contentment. Scenes of happiness and beauty get their radiant glow from the mind so lifted that it reflects the pictures of the heavens. To ennoble this calling would be to attract the best elements in its practice, and what is now the rugged and uncomely scene of drudging and plodding would charm by the soul beaming out from it. Much might be said on the utility of American country homes as political conservatories of germs of thought—life that love to evolve in the air of freedom. Natural liberty here grows with its spontaneous rights, only mechanically bounded by the molding of self-imposed laws, in this is to be found the true type of the republican character forming under the healthy agency of public sentiment, influenced by the pulpit, by moral factors, by the gentle, social ties of the commercial brotherhood—the man evolved by the natural selections and free-agency of his own volition under the incentives that flow in from the ideas of his own adoption. This is the propitious state for the development of true manhood and is not to be found any where more than in the rural realm when civilization is there domiciled with her virtues. This is the provision of nature for the self-acting society on the highest plane of honest growth, this composes the healthy assimilation of the good, the useful and the true in maturing the statehood and nationality under the organic laws we find imbedded in the human heart, nurtured into forceful action by the inspiration of *choice* with the genius of self-respect and patriotism purifying the sense of liberty. The responsibility of right-doing here becomes more apparent, and the school of virtue is ornate with the flowers of our own culling and the jewels in the diadem of honor is the sunlight of genial nature, playing upon the countenance radiant in sympathy for the true. Here the occupation is one in partnership with nature, and we learn *her* ways. The man, if he be true to and

in love with his work, reflects this kindly nature—art and nature blended in true alliance present the most eloquent expressions met with in the scenes of life-work. The glitter of the traffic world, and the gew-gaws of the purely human have done much to win man from the teaching of the “lily of the field,” but in this broad continental estate of the great Master, where simplicity is written from the organic law of the Constitution down to the domestic training of the household, we will find people ever turning from the scales where the “pound of flesh” is weighed to seek refuge and wisdom where nature is found most supreme.

From the golden home of the citrus and the flower to that pacific land where the dwellers are under their own vine and fig tree with hearts mellow in contentment and oriental in dreams of peace; thence over the way of Egyptian plenty through the great and solid West to the land of the fathers, from whence has flowed our civilization, our religion, our liberty and our vigor, we find a class of men simple, but grand in their sturdy labor, loving their calling and ambitious to place it of more value in the hearts of men. They represent a business that is the foundation on which a great superstructure is erected and being yearly enlarged. As the streams of life and trade and business leaves this source they depart from original purity and are infected with the grosser passions that are born of the conflict of man with man. The material that is furnished by the grower to the markets puts the scramble in motion, and as long as money and men will stand a profit we see the little fellows standing on the margin in line of battle with their tomahawks. We have great respect for those who buy to add labor to the raw material and convert it for higher and better use, in other words, for the manufacturers. The storage men who buy and care for articles in commerce and sell at a profit representing their labor and expense; the public carriers, these are welcome coadjutors in the great field of distribution. The capitalists, too, who render facilities in aid of these different departments of labor are friends to progress and to man. These are the branches of industry that constitute the legitimate machinery of the world's business, and, if conducted with conscience and right principles, all will go well. They are the

intermediates between the producer and the great multitude of actual laborers. At either end of the line, then, stands the producer and the poor, between whom there should be sympathy and co-operation on the ground of common interest. Their policy is to fight out the pure speculator with an unrelenting war, and to deal kindly with the agents for distribution and with their other friends, the manufacturers. In this connection I must say I am not of those who would deal blows to home industries. I can't help but approve the doctrine that enriches my neighbor. I would like to see riches flourish around me, because I would then live in a better atmosphere and live the *cheaper*. I would not turn loose cheap labor, cheap machinery and cheap goods upon my own market to break down home manufactories whose very industry raises the value of my products and whose laborers increase the demand for them. I could buy a wool hat made under the operation of free trade cheaper, but I could thereby impair industry, cheapen the price of manufacturing labor, cheapen my own products and deplete the veins of an enterprise whose life-blood flows in vigorous currents to the citadel, the common heart. With the "plant" of manufactories near our lands they increase in value directly and remotely. Their natural effect is to introduce laborers and to multiply and densify population and thus add to the demand for our products of the soil and to increase land values as well. But the argument has most force when we determine that progress shall not leave us in the rear, but that we will become a manufacturing country. No section more than the South invites and could better sustain this enterprise. Protection is a high bid for labor, and thus becomes a useful agent for the encouragement of immigration. Nothing has done so much to aid industry and increase wealth as immigration and real estate movements, and as a body of land men, all meetings of this character should be stimulated by every impulse from whatever direction.

We want immigration, and this is another feature now to be mentioned. To give life and push and confidence to the agricultural world there should be liberal dealing in real estate. It should be readily in demand and have exchangeable value. Real estate agencies should be encouraged for they tone circulation

in a way to make the body of our kind of interest healthy. The West has been made by well organized schemes for its population. I often see agricultural papers read this way: That "the people have been robbed of their rich inheritance, received by them from their Creator, by land grants to railroad companies." This same paper would in all probability be at white heat favoring immigration. The most practical scheme possible to this end is to engage capital, paying it good profits to embark in this enterprise, and it is thus induced to become active. The love of gain converts capitalists into progressive workers for the good of the country. They get paid. They people the land. They are models to young America as industrial examples. They build up towns, the towns engage in enterprise, the companies grow rich, and the people get quick benefits from their riches. If left to natural movements of men none but a Davy Crockett would start to a wilderness. The man who fled at the sight of a human track in his wild home, for the reason that he had discovered too near a neighbor would be about the only one who would go out in the wild for his God-given inheritance. Who are the people the papers referred to that are so abused through these land grants to corporations. The actual settlers put there by the company or corporations are as much the people as any who would go on the lands from original suggestion, and are just as much God-sent inheritors. The farmers are the class who talk most about this "diabolical scheme," and are of all others the very people who are most interested in transportation. I would like to see all public carriers rich. We want public highways in splendid condition, safe for transporting life and commodities, and we want the currents of trade flowing rapidly and well. Away with the croaking of farmers. Let them mount fully the tide of progress. Let the spirit of true liberality incline their hearts to more charity and "to keep this law."

There is no doubt but the farmers are the best class of people, and their participation in the more active and live agents for progress could purify the air and render these factors more capable of good. The agricultural journals of the country are too prone to fix ideas unalterably in one direction regarding the great levers for development. They are conducted for the

most part ably, and more information is to be had from them than you will find any where else, on subjects they treat, and they ought to be more encouraged and liberally patronized, but if they could lead the farmer into more liberal views as to the true worth of capital plans for general development and thereby the more sustain farming interests, in my opinion the enlargement would do good. We ought, too, to invite the general "newspaper" more to our interest, to get their attention and their work in our behalf. We are glad to see them represented here; they are the great organs for the people, devoted to all interests; they are the exponents and leaders of opinion; great luminaries that compose a system where ideas gather in constellations to send their force as light into the brain of action to render a product for joyous harvest. We will disobey the old command and "build our fires in high places" to welcome this light of our day as it rises above our horizon to warm into development germs that have slept too long holding some blessing to be nurtured into life. When a new body appears in the heavens, and its light descends upon the earth, some dormant and hidden germ of the vegetable kingdom is responsive to the call that has been coming through the ages—a new force, and man converts it or transmits it, and a vital force in the human world, though as simple as the "babe in the manger," starts out on a new mission grand in results for the higher destiny of man, and heavens declare its glory. The heavens are farmed out for the maturing of great truths to appear at their own proper time on that scene where man is enacting history before an audience of angels. So the lights that arch our way in the intellectual firmament, the "stars in the East" are beconing the "wise men" to take notice of the eras that are born under the electric inspirations of visitations from on high and to give the mission of ideas their true place in this age of development. These paper organs, with apostolic mission, are sowing the seed of regenerative life in the distribution and dissemination of thought along the currents and through the views of popular humor. We want them to live more in the fresh air of the fields and to give their rich thoughts the pulsations of pure nature. They are the thinkers who think aloud, and we want their heart beats in tune with

the hopes of that great interest that now seeks to march with the proud tread of good purpose, and who seek to pulse the music of the woodland and the meadow into the body politic, and into the mart to tone sweeter and happier the hearts of men. We want advocates for the hopes that are in us; we want to see the editors counting the stars above us, tracing our destiny.

Joseph turned the farming interest to account. He watched the stars in their courses and foresaw the seasons, and linked his success with his future. But this is pleasantry; we want a real interest felt by them, based on broad principles, in this greatest basal work of a people. This powerful interest we here represent is beginning to feel its weight. Muscles have not been exercised in vain. It has been an unwieldy giant—gawky, rustic and blundering—but has listened to the regular and smart clip of the shears in their habit of fleecing; it has seen the system in the *plans* of exactions; has heard the measured tread of the law-abiding plunderer; has observed the dignity of statutes in the finished grace of shackling; has, above all, seen with lively interest and much instruction the panorama of government weeping for the poor and weak in the pose of sentiment, but ever with realistic earnestness forging fetters by another name—yes, even with mono-metallic ring, naming them golden links. These things, so long in sight, have educated in the tricks of trade, and a bold honesty of purpose will now assert itself with modest claims and ask recognition in humane treaty with the business and political powers. First, after maturing through experience, through the schools, through unions, interstate and otherwise, the perfections of sense as to the best methods of production, the maximum yield with the help of science; then, secondly, through the weight of our massed forces employing the divine gift of rational foresight, we will seek to be the masters of practical routes, the shortest and the cheapest, to points of destination for the bulk of products. Not only this, but establish the policy that will invite demand for them, to make markets where they do not exist and maintain those that do, upon the policy of equities that shall not be disturbed by the cormorants that infest the highway. Interchange and exchange bearing in their bosom the certain and

mutual fairness that will blend benevolence and charity as the handmaidens bearing the scales of just equalization of profits. Does this sound Utopian to the callous, cold-blooded, stony-hearted Shylock? Answer by pointing to Paul, the re-made Saul of Tarsus, and affirm the truth that this maker of tents spread a pavilion of liberal views under the free canopy heaven, though in the service of another cause, when intercommunion quickened and enlivened and spread its benefits by breaking down the walls of prejudice and hate where the exactions of tribute by the masterful hand had before been the rule. The Master he served gave to commerce a soul, while he was reforming the lives of men with brotherly love—God's evangelist to the hearts of men, bestowing the principle, and thence the *policy*, that would feed His lambs. But I am not sermonizing. I only cite my authority, as the lawyers say. This argues the great *possibilities* in trade expanding the soul for the virtues to rule the terms of dealing. These industrial heart-beats by States in harmonious interlife sends the current of blood to the brain, interlinking thought in the broad arena of generalization, the work of unification will go on until consolidated sense and virtue will move the forces of the nation subject to their will for the good of men.

This is the ultimatum; to substitute the people and the will of the people when they are moved by a great spirit, instead of monopolies and the rule of the few. But as indicated in the foregoing part of this address, we move to purify, and not to crush. We have been blowing horns a long time, but the walls of this day are not so prone to crumble before the breath of virtue as those of Jericho. Our faith is not weak, but heroic treatment commends itself, though it ought to be characterized by the qualities that belong to heroism. We wish all the vital force of progress in corporations to live in the full grandeur of their mission, but more mindful of general good. It would be a deplorable day that witnessed an organization of farmers for office, imbued with a spirit of depredation on other interests; they should rather mingle in common union with all classes, maintaining their doctrines, and take the chances. Public truth is not enforced by faction, though there should be unions

of like interests for self-defense and intelligence sake. Now we come to another proposition that will not, perhaps, meet with common assent and support, but one it does seem to me that agriculturists, and especially landed men, should generally concur in. It will be seen that in this talk I have proposed no war on any solid enterprise or interest having the good of the people as the fixed principle for its government. I do believe that the farming world ought to defend itself against a policy that aims unfriendly legislation, theories and practices to its interests. I believe the present monetary system works an injury to agricultural interests. Money does not seek investment in lands. So to speak, lands compared with money are valueless. Money has too high a value in contrast with other property; it does not measure properly. The medium of exchange should be favorable to and encourage exchange; active trade by exchange inspires confidence in the kinds of property involved in the transfer, and equalizes the motion of general industry, making none the prey of others. To paralyze any industry by discounting it amounts to depletion in the life-blood of industrial energy. Circulation ought to be unobstructed. To-day land has no value, except where capital combines to force a population and a demand. The general disposition everywhere is to convert other property into money because it alone has superior value. Money should only be a convenience. If it should be cheapened, then it flows toward investment, and then the solid working enterprises absorb it in use. It will be said in reply, that money will employ itself wherever it receives good pay; in other words, it will invest itself in paying property. The answer is that its high rates of interest and the great demand for it in production and general business keeps it from investment and prevents other kinds of property from paying. It works industries hard to pay its interest, and prevents demand at remunerative prices for the products of labor, because enterprise cannot afford to handle them, except at great depreciation. It looks that money made so good, so valuable, that we ought to appreciate its high value, for when we acquire it, it will buy more for us. The trouble is that it cannot be acquired under these conditions, and another objection is that we, who are on the other side and sellers, do

not want so little to buy so much. We represent land and its yield, and we prefer much money offered for it than a little.

It will of course be said that if you sell for low-price money, cheap money, that when you get much of it you have got less, to use an Irishism. But here is the point, cheap money is eager for your property to exchange itself for a better something or value, and in this competition for your property it stimulates the value of your property with the proportion of increased value in favor of your property, and is by far more than an offset for the decrease or decline in money value. Land thus quadruples while money does not depreciate in same ratio. But why is it desired to give land and its products an especial value. First, because we own it, and for the same reason that money wants undue appreciation, and because a greater part of the people are interested in it, and the question should yield to the greatest good to the greatest number. Secondly, because we believe realty the first basis of value and establishes the safest and most trustworthy power for the social, domestic and political conservatism of best factors in human rule. If you would wreck a nation's prosperity discourage the land-worker by disgracing his calling, bring it into disrepute by making his estate of no value and his avocation of no respectability. We love the uses of money for the great purposes of human advancement, but when it gravitates into oligarchical rule for despotic powers and to cramp and enslave a people, we say put it in sackcloth that it may learn the lessons of adversity and be educated into the knowledge that the great forces of this world are intended to move subject to universal laws in the realm of beneficence. We would not say fix the rate of interest by law, for we believe in the play of as much liberty as possible to each and every interest and human right. But we would say cheapen money by its liberal issuance; no restrictions on silver coinage—that great home product. We do not mean by liberal issuance the greenback plan, for we do not believe in extremes. Give us liberal appropriations on part of the general Government for internal improvement; give back to the South its cotton tax; pass the Blair Educational Bill; build the Mississippi levees; rebond the national debt when not violative of the law of the contract expressed in the bond, by continual offers to takers at

lower rates of interest, so that money could be less on the limit for this dormant treasure. Build a commercial marine and manage our foreign commercial policy by an able commission directing the distribution of American surplus products. Let us as industrial agents open up all the avenues for the aggrandizement and the success of labor, divesting it of those barriers that obstruct and depress it. It is labor that we would foster and cherish; it is the material bound into the arena that we would apotheosize; it is the old heathen god of reproduction we would install anew, but we would have him appear at this coming as the second ruler in the kingdom—the kingdom of *christened* powers. We do not believe in the perversion of great powers intended for man's good. Everything accumulated beyond self need should again be exerted on the extending wave that in time "circles" the human family. Healthy work is ever the regenerating agency—the principle of renewal of life in some form belonging to action—the civilizing elevator of the human race. The fortunes of men must be kept in motion and share equally the chances. If the vortex in the whirl of action whelm some in ruin the asylum of kindness and help must be man's charity to man. Mankind must take care of their fellows in misfortune. If we are kept at the maximum output of earnest endeavor in labor's field, the wealth of the world will fold in kindly embrace the disabled. It is honest labor that calls for our respect, to recognize it everywhere in the walks of life, and to honor it with that kind of co-operation that each case demands, whether with alms or a helping hand to its live energies. When the common effort of man is for the common good there is a contagion in the willingness that takes hold of impulse, and there are more people than we dream of who are anxious to be written in the catalogue with Ben Adhem.

All true work must not only have self at the bottom, but, to be effective, must "scatter seeds of kindness," for there is a productive sun that shines upon men's hearts, and the cultivation in that field is the rebuilding the temple after the deliverance from captivity, more truly, the reinstatement in the primal home where kindly curse "by the sweat of thy brow" leads us back again through the circling ordeal of the world's labor to the gates on the other side, the garden of Eden at last, and

“peace and brotherly love” renew the garden of the heart. The popular right to the blessings of prosperity constitute a wholesale demand for the righteous and just ends of living. What the people *will* must be the sovereign authority. The sovereign will must advance the labor idea in the lead of development. This is the necessity. It is work, work, work, and it is this that we of the South should make especially the prominent feature in our history. Our invitations are to those over the world who will come and affiliate with us in the material development of the abundant resources that are now appealing to the strong arm of industry. Our laws will protect them, our society will welcome them, our politics, fast forming on the issues of material things, will prepare the moulds to cast their ideas, for we will dwell together in peace with our common hopes blended under the same benign auspices. Our people have had the ordeal of a great and fruitful experience. The masses are being moulded aright, ever rectifying man on the plans in accord with that Providence that gives to the genius of freedom and industry its plan. The agricultural and industrial features of our people gives a face to destiny that inspires us with faith that this plan is mapped on its countenance, and its expressions, mingling with the smiles of Providence, traces the outline of the future in the imagery of a handwriting more eloquent than man’s. To the many who are here to-day prospecting for homes, we would say look into that face for invitation and welcome.

THE GRASSES.

THE RELATION OF GRASS TO AGRICULTURE.

BY J. P. STEELE, ESQ., WINTERSSET, IOWA.

Without agriculture there could be no civilization, no science, no art. All the great cities, railroad corporations, steamship transportation companies, manufactories, in short all the great

enterprises of every kind and nature, draw their wealth, derive their power from and depend for their very existence upon the farm ; not only so, but I venture the assertion that nine-tenths of all the financial kings and eminently successful business men—nine-tenths of all the great statesmen and jurists, doctors of divinity, and doctors of medicine received their early education, training and physical development upon the farm. If it were not for the constant crowd of robust men and women who are rushing to the cities to make their homes and fortunes, thereby keeping up the physical and intellectual tone and stamina of their inhabitants, it would not be one hundred years until the cities would be peopled with a race of physical and intellectual pigmies. If the cities did not draw from the country people with better constitutions, more vigorous intellects, deeper convictions, loftier ambitions, purer and nobler impulses and emotions than their native-born citizens, in time they would inevitably succumb to the contaminating and enervating influences that surround them ; and instead of being the centers of great enterprises and the happy homes of good and great men as they are, they would become the centers of iniquity, and the victims of their own vices. So that it is a matter of the greatest importance not only to the farmer, but to this whole nation and the world at large, that the science and the art of agriculture be carried on in the most skillful economical and pleasurable way possible, in order that the people who go from the country to make their homes in the cities may be of the best and highest type of manhood and womanhood.

Agriculture is at once a science, an art, and a business—a business by the way in which there is the fiercest kind of competition, and unless the agriculturist is wide awake, up and doing with all his might of brain, energy and industry he will be found in the rear rank marked as one of the failures.

It is a matter of great satisfaction to know that any farmer endowed with ordinary ability who will read, think and act with energy and wisdom, may lead one of the most independent, healthful, influential and happy lives. It is also a matter of great satisfaction to know that in the last fifty years there have been made wonderful strides forward in the modes,

methods and appliances adopted and used in this the king of all vocations. It requires more brains and less muscle to farm now than it did fifty years ago. The researches of naturalists, chemists, geologists, botanists, are annually throwing a flood of light upon this the chief of all the industries which makes plainer its underlying principles and furnishes a more certain guide in its practice. Now if we could only learn and thoroughly understand the fundamental underlying conditions of permanently successful agriculture, we would not only be making for ourselves many dollars, throttling many a disappointment and converting many a failure into a grand success, but we would be making a discovery that would be of lasting benefit to the human family.

When I was a boy, I remember to have heard it said that "cotton was king." Later on in life in a different section of this country, I heard it said that "wheat was king." On still later, in another section of this grand country I heard it said that corn was "king of all the products." Each of these three assertions contained a measure of truth in the particular locality in which they were uttered; but they lacked a long way of containing the whole truth even in the localities to which they were applicable, and much less were they true when applied to this great broad land of ours. I believe the natural monarch of all the annual products of the earth to be a hereditary one—she is a queen regnant, and her name is "Green Grass." She rules with a scepter that is tempered with mercy and brings peace and plenty, prosperity and happiness to all within her dominion. The grasses are the most universally diffused over the globe of all flowering plants. There is no district in which they do not occur and in nearly all they are the leading and dominant feature of vegetation. Grass is the natural, and should be the staple, product throughout the length and breadth of this great land. (Now I use the term grass as including only the grasses that are mowed and pastured and not in the broad botanical sense.) I do not mean that grass should be grown to the exclusion of all kinds of grass and everything else, but I do believe that the greater portion of every farm should be in grass and that grass should be the chief crop.

Now let us notice and see what would be some of the effects of this kind of farming: And first, it should be the aim and it is to the best interest of every farmer to keep his land as rich as possible, and in the highest state of cultivation possible. It is a well-known fact to every tiller of the soil that a continuous raising of any kind of grain, cotton or tobacco impoverishes the land, and if followed up year after year, will not only bankrupt the farmer, but bankrupt the soil. There must be something done to restore to the soil the properties that are taken from it by the growing of the various kinds of grain, cotton or tobacco. Now who ever heard of a farm getting poor by being kept in grass? No one. In the older settled portions of this country it is the only sure way of raising anything like a paying crop of any of the grains by plowing up meadows and pastures, and sowing them in grain for a few years and then putting them down again in grass. Grass makes a poor farm rich, it makes a rich farm richer. Grass restores to the soil the elements that have been absorbed by the grains. Grass keeps your soil from washing away or being blown away. Now compare the expense of running a farm where it is largely kept in grass with one worked in grain. How many hired hands must be kept on a quarter section of land that is worked in corn, wheat, oats, cotton or tobacco, or all combined? How many dollars must be invested in machinery to work these crops of grain? How much grief and vexation do you have with these hired men, the one-half of whom are apt to get mad and leave you just when you need them most? And what about the feelings and happiness of the faithful wife and daughters who are toiling and broiling over hot stoves preparing food for these hungry hired men? You practical farmers can figure on these costs, and weigh these considerations at your leisure. On the other hand, take a quarter section of land all in grass except twenty-five or thirty acres of fresh turned up sod which one man will tend and take charge of the balance of the farm at the same time, and will, in all probability, raise more grain than three or four hands will from ground that has been impoverished by being kept in grain year after year. Here you have one man all the time and a few extra hands during harvest tending as much land as four and maybe more would work in

grain. Compare again I say, the expense of the grain farm and the grass farm. Why, I know of farms consisting of a whole section of land that are managed by one man except in harvest, and if every machine and tool on the farm was sold under the hammer to-morrow they would not bring three hundred dollars, and their original cost would not exceed five hundred dollars. And these farms are profitable ones, too.

Some one may be ready to ask what will we do with so much grass? How will it be converted into the "almighty dollar?" The answer is, feed it to good stock. And again it may be asked, How are you going to keep stock enough to eat up so much grass, with so little grain to feed them. I unhesitatingly answer that neither horses, cattle or sheep need any grain after they are one year old, except horses at work. Years ago up in Iowa it was thought that horses, cattle and sheep must be fed grain and hay, or corn fodder from early in the fall until late in the spring, but experience has shown this to be a great and expensive mistake; for when blue-grass pastures are saved for winter use it is only necessary to feed good hay during the time the ground is covered with snow, and deep snow at that, whether this time be three months or three days, and as a matter of course the further South the shorter will be the feeding season.

Now, it is a fact that the great majority of farmers are men with moderate means who only own or rent about what land they can work themselves with perhaps a little hired help during the very busy season. Think for a moment of the difference in the hard work and drudgery that the man has to perform who devotes his farm to the raising of the grains cotton or tobacco, and the man who devotes his land to the growing of grass and raising of stock, and has the sweet satisfaction of seeing his horses, cattle, sheep, and even hogs do their own harvesting, threshing and grinding for eight, nine, ten, eleven and maybe twelve months of the year, fed almost the year round by the hand of nature, instead of the hand of man. The length of time these animals take care of themselves depending somewhat upon the latitude in which their owner lives. But there is a much more important end to be attained by changing

our system of farming from grain-growing to grass-growing and stock-raising than simply the saving of labor. It will bring about a change in the lives, characters and mental habits of our farming population. It will necessitate a higher, broader and more universal intelligence and refinement. The farmer must become a better reasoner, a closer observer and generally a more thoughtful man. The grain farmer, or tobacco, or cotton raiser has but one problem, and that is how to raise grain, cotton, or tobacco. They have their difficulties and mysteries which require thought and skill to solve, but they are simple and easy to be understood, compared with the problems that present themselves for solution to the man who raises just a little grain, a great deal of grass, and enough stock to eat all up. He must study not only how to raise grain, but how and when to feed it with the best results. He must also study how to grow the greatest number of pounds of hay to the acre, and how and when to harvest it, so that it will be the most palatable and nutritious for his cattle. He must find out the kinds and varieties of grass that must be sown in his pastures, in order that he may have the earliest pastures, and the latest pastures, and all the time the most luxurious and nutritious pastures, and hundreds of other questions or difficulties that will be met and must be solved by the grass farmer. And right here opens up another great and almost untrodden field of thought—the science of breeding. If a man is going to be a grass farmer, and raise stock to consume it, he must first determine what kind of stock will do the best in his hands with his surroundings; and then what breed or breeds of the kind selected, and then commences the task of developing the best specimen of an animal that can be developed with good blood, good feed and good care, controlled with the very best judgment that a man has after gathering all the information that he can from all the sources within his reach. So that the man who devotes his farm to the growing of the grasses and their consumption, is a manufacturer, and that, too, of the highest class, dealing as he does not with dead matter, as does the mechanic, but with life, striving and studying what forms of life to bring together, in order that they may take on the most beautiful forms of the highest utility.

There is no question but that farming and stock-raising opens up to man a broader and more beautiful field of thought than any other vocation known to man. Its pursuit affords scope for the most profound and accute minds, and food for thought that may be relished by the most refined and cultivated.

Now let us look for a moment at the general appearance of the country that is almost entirely devoted to the growing of the grains, cotton or tobacco, or all combined. During the summer it is an interesting scene of beauty, but after the harvest is over and gone, it presents a scene of universal death and decay. The dry-looking stacks and shocks—dead cotton-stalks and corn-stalks, reminds one of a grave-yard. It presents but little to admire, but little to think about—suggests nothing but death, or another mighty hard summer's work for both man and beast. Turn from this scene and let us view a great scope of country sown in various kinds of grass, with here and there a small patch of grain, just enough to lend variety to the scene. Here we have a scene of green from early spring to the flying of snow. What is prettier than a vast expanse of country covered with the many shades of green beautifully blending together; and to add picturesqueness to the scene, there may be a stream of water winding its way through the meadows and pastures, while on this side and that there may be standing a clump of trees. Now, upon this scene of universal green, we see here a flock of sheep, that golden-hoofed animal about which so much has been written; and there a drove of prancing steeds, and yonder a lowing herd, all feeding peacefully and leisurely upon the almost native crop of mother earth. Here we have a scene of green almost from January to January—a scene of sprightliness—of vegetation and animal life and activity—a scene of beauty, and what is it that quicker attracts the attention, and goes more directly to the soul of man, than beauty? Beauty is no mean influence in the development of man. It is said, and I verily believe it to be true, that the character of the scenery which surrounds a man during the growing period of his life has much to do in the formation of his character. If this be true, it certainly behooves every farmer as he respects himself and loves his wife and little ones,

to follow that system of farming which will most beautify and adorn the home of his choice. Let us imagine, if we can, the difference in the feelings and emotions, the character and the scope of the thoughts of the man who goes plodding over his fields of grain, cotton, or tobacco, and the man who steps out over his fields all carpeted with green; watch him comparing this bunch of grass with that, evidently thinking and reasoning about their comparative beauty and nutrition, and planning how the degree of each may be heightened and improved. Watch the expressions of satisfaction and delight playing upon his face as he moves about among his flocks and herds, admiring this animal and then that; comparing this one with that one; all the while studying what change of feed and combinations may be made that will add to their beauty and utility—increase their value and his wealth.

Is there, or can there be any comparison in the feelings and emotions, the character, breadth and variety of the thoughts and consequent mental development of the man who devotes his time to the growing of grain, cotton or tobacco, and the man who gives his time and thought to the growing of the grasses and the necessary accompaniments of grass-farming?

I tell you, that the greatest problem in the agricultural world—the problem that has more to do with the wealth, the intellectual development, the virtue and the happiness of the civilized world, than all the other agricultural questions combined is the problem: How to grow grass; how and when to harvest it; how to feed it, and what to feed it to.

GRASS CULTURE.

THE NECESSITY OF CULTIVATING THE GRASSES IN ALL PARTS OF
OUR COUNTRY IN ORDER TO MAINTAIN AND IMPROVE
THE FERTILITY OF THE SOIL.

BY A. P. FARNSLEY, ESQ., OF LOUISVILLE, KY.

We find on investigation that the number of species of animals, plants and insects run up into the thousands, and that each animal, plant and insect is of use in some way, and all have had a share in making the world a fit habitation for man. A little knowledge of the relation of things will show us that all living things, both animal and vegetable, form one long chain, and as Pope has aptly expressed it,

"Tenth or ten thousandth, breaks
The chain alike."

Then, to do away with all animals but one or two species, and to keep them in limited numbers for special purposes, and to neglect all plants but one or two species, is evidently reversing the order of nature, and must necessarily be a ruinous policy for the husbandman. The world cannot be made richer and richer as time rolls on, as it should be, if we continue in the future as we have in the past, to war against nature's laws. It is quite evident to the student of nature that each plant, animal and insect contributed something in its own peculiar way to the fertility of the soil. Each carries on a part of the process of converting the raw materials of nature into plant food. A load of grass that rots on the plain is quite deficient in some of the elements of plant food when compared with grass that has passed through a horse's stomach. The same can be said of that which passes through all other animals. The fertility of the soil is not only maintained by animals and insects, but is yearly added to. If the fertility of the soil was inexhaustible, the discarding of all animals, plants and insects but one or two species of each, would have some show of reason in it. But

the richest soil, when cultivated for any great length of time without the use of fertilizers, becomes exhausted and incapable of producing paying crops of any kind, and there is really no excuse for such a system of farming.

What part the grasses performed in making the earth rich and productive and capable of sustaining the millions of plants, animals and insects that we find wherever we go, we cannot, with the knowledge we have of the subject, even risk a guess. But that it was considerable, and probably greater than that of any other class of plants we have no reason to doubt. That it was in the past, as it is now, the greatest life-sustaining plant in existence, we could, if we had time, adduce many facts to show.

If the world was one vast plain and was cavernous like a part of Kentucky, so the surplus matter could be quickly drained from below, or if the land was just sufficiently elevated to allow the surplus water to flow to the creeks and rivers and finally to the ocean, without washing the land, we would be puzzled to know our indebtedness to the grasses for our extensive flora and faun, and for the fertility and beauty of the world. But as the surface of the earth is hilly and mountainous, and capable only in a few places of being underdrained, we can easily see how necessary the grasses were in the past history of the world, and how indebted we are to them for many of the blessings we enjoy. We can easily see how, without them, the mountains would have remained treeless and sterile, and how limited our tillable land would be.

Of the various mutations of the grasses as they slowly developed, our knowledge is nothing like as extensive as we could wish it to be. We know the flowers antedated man and perhaps all other animals, and we have reason to believe they are among the oldest of plants, and that they were widely distributed before forest trees made their appearance. These facts enable us to understand the part the grasses performed in making and fixing permanently the surface soil of the earth before it was tilled by man. If we wish to know the real value of the grasses, and how we cannot dispense with them for any great length of time, in any part of the country, we should neglect no opportunity to study these facts.

A knowledge of any country before it was occupied by civilized man will show us that there was no waste land that was once rich, that there was no draining the soil by a natural process, but on the contrary there was a constant improvement of the soil, and as years passed the land was capable of supporting a greater number of animals and plants. Whether the land when first occupied by civilized man is covered with a dense forest growth, or is covered with grass alone—is level or rolling, the soil keeps its place. Wherever the grasses exist and are constantly cropped by millions of wild animals, as in our Western country only a few years ago, there is never any evidence of weakened fertility of the soil. No rocks are laid bare that were once covered with rich soil. There are no ugly gullies, no rich bottoms ruined, and no place where the soil is being washed away, little by little, as time rolls on. The drains are just sufficient to carry off the surplus water. Every plant retains its natural relation to other plants and animals. Animals abound and feed on plants and other animals, and quickly convert what they eat into a fertilizer. The animals die at different places, and their bones are evenly scattered over the land. All that is taken from the ground is returned to it with interest. Such is the natural process of working the soil and producing crops. But mark the change when the land falls into the hands of the civilized man. The balance is everywhere destroyed. Relations are broken up. All animals, insects and plants but a few species of each are either destroyed or driven off. The fertilizing process of nature is at once arrested, and the impoverishing process begun. Everywhere we see waste and the pressure of population on the means of subsistence becomes a serious matter, and is the excuse offered for the abject poverty of the masses. In the face of all this wanton waste and destruction by man, our philosophers tell us that it is the poverty of the soil that limits population, and gives the masses in densely populated countries barely enough to live on. Let our philosophers get wisdom from the study of nature, and place the blame where it justly belongs—that is, on the ignorance and folly of man. The fertilizing matter that is annually wasted one way and another is frightful to contemplate. To say nothing of the impoverishment of the soil that cannot be freed from its place

by washing, the enormous waste and ruin that is wrought by washing of all undulating lands is well calculated to make the wisest of us tremble for the future of the human race, if it increases in the future as it has in the past.

The waste in plant food would have been much greater than it has been if it had not been for the roots of plants. By them the land was held in place, as the water after every rain rapidly flowed to the low places. The roots of what class of plants did the most good in this way is not hard for any one acquainted with agriculture to guess. Every farmer has witnessed the washing of hillsides, and has seen the washes checked and the repairing process commenced by the use of the grasses. There is in fact no other remedy for such drains on hilly and rolling lands. It matters not how scientifically we plow to prevent the soil from being washed away, we cannot be successful for any great length of time. Our soil will go at last, in spite of our efforts, if we persist in neglecting the grasses.

It is claimed by some that prior to the occupancy of the land by civilized man, timber growth was the chief agent in preserving and enriching the soil. But this cannot be so, for long before the hills would have been rich enough to support large trees, the hills themselves would have been washed away, if it had not been for the grasses. Timber enriches and preserves the soil after it has been made, but that it did not precede the the grasses on any land is evident enough. In many places where the timber is now growing and has never been disturbed by man it is quite evident the land is not as good as it once was. It has been injured by washing since the timber got possession. As long as the land was covered with grass, every inch of the soil for a considerable depth was penetrated by roots and firmly held in place, and all decaying matter was prevented from going with the water after rains by the grass above ground. When the timber got possession and the grasses were completely smothered out, large places between the trees became bare of roots of any kind, and, where the ascent was steep, all the leaves and twigs that fell from the trees were carried away by the water after heavy rains. A little of the soil was carried away each time, and in the course of time no top soil was left in such places.

In many instances where the land is cultivated in plowed crops, as soon as the timber is removed, the ruin is complete and irreparable the first year. Who of us has not seen this? Who has not seen land ruined this way which, if it had been seeded to grass and pastured as soon as the timber was taken off, instead of being plowed, would have kept up indefinitely. In some places it takes a long time to complete the ruin of the land by washing. In some cases the waste is hardly perceptible in a dozen years, but centuries of cultivation without the aid of the grasses does the work at last. This never could take place on land but slightly inclined to wash, if the plowed crops were frequently rotated with the grasses, and grazed with stock. It cannot be denied that there are instances where the land was not touched by the plow after the removal of the timber, and yet it was ruined before it was set in grass. But this did not happen because grass could not have saved it, but because the timber was not properly removed. The change from timber to grass is much more difficult on steep hillsides, without injury to the land, than the change from grass to timber. In the latter case the change is gradual. One has possession before the other is crowded out. Where the timber is superseded by grass it is necessary to almost completely destroy the timber before the grass can get a hold to do any good, and in the interval between the destruction of the timber and the appearance of the grasses, the land is greatly injured by the starting of washes. Where the change from timber to grass is natural, owing to the time necessary to effect it, no harm is done to the land. In hilly regions, alternations of timber growth take place without the presence of the grasses, and yet the land is not injured. This is because the great quantity of wood on the ground holds the surface soil in place until the new timber is started. In all such cases the presence of the grasses is not necessary to preserve the soil. It is when alternations of timber growth have taken place through the agency of man that the land is injured.

In order to see what cultivation of the soil has done with and without the aid of the grasses let us observe what changes have taken place in all cultivated lands since the dawn of authentic history. We are told that Palestine, Syria, part of Greece, and

a great part of Persia once supported a dense population, and, according to the expression of history, actually "flowed with milk and honey," which means those countries annually produced everything in the greatest abundance necessary to the comfort of man and beast. Where is the rich, fertile soil that once produced so abundantly in those countries? Where are the descendants of those dense populations? Why is nearly all the land a waste—treeless, unable to support either man or beast? Because the value of the grasses were unknown, or, if known, for some cause were pressed out of the service of man.

The same cultivation that brought ruin upon the countries I have just named, is being repeated here in America, only on a much larger scale, and we need not delude ourselves that we can play the game without being subject to its hazards. There is but one law for the Jew and Gentile in regard to the cultivation of the soil. All must obey it to reap the reward.

That the grasses and herds of hogs, goats, sheep, cattle and horses could have saved the lands of the unfortunate countries of the East, and sent them down to us more rich and beautiful than when man first took possession of them the history of other countries abundantly shows.

Scotland and Switzerland furnish us evidence on this point. The climate of Scotland is not good, and her lands at one time were far from being fertile, but by the proper use of the grasses, in connection with large herds of sheep and cattle, the hill-sides have been enriched instead of being made poor, and are now capable of and do support countless herds of sheep and cattle, and the lowlands have been so enriched by means of the herds on the highlands that they annually produce enormous crops of wheat, rye, barley, potatoes, turnips and beets. If it had not been for the grasses Scotland and Switzerland would to-day be barren wastes.

But notwithstanding the many examples of waste and destruction of the soil, where the grasses and herds of all the domestic animals are strangers to the husbandman, and the productiveness and preservation of the soil by the use of the grasses and domestic animals, our people in many parts of every State of our Union, seem to be ignorant of the necessity of cultivating

the grasses and raising stock. I am well aware that in many places pressing need force the people to cultivate plowed crops, contrary to their better judgment, but certainly such pressing need cannot be anything like general, in any considerable part of any State. In the countries of which I have spoken as being ruined by bad cultivation, the people did not have choice of crops. The unwise and wicked rulers of those unhappy countries cared nothing for the people or their happiness, nor did they once stop to consider the interests of posterity. They made pressing need for man and beast, every month in the year, and when a people are threatened with starvation they cannot wait till the calf is born and grown into a bullock. They turn their attention to any crop that will feed them, and that will grow the fastest and mature the quickest. I know in many places in our country the necessities of the people and such grasses are not cultivated because they do not bring quick returns. But all such necessities are of our own making, and whether the result of our ignorance or folly we are none the less responsible. We cannot excuse ourselves with the plea that the climate of any part of the country is not adapted to the growth of grass.

Even in the South, where the grasses are least cultivated, there are more valuable grasses to be found growing wild, both native and foreign, than in any other part of the world. Have we native grasses adapted to every condition of soil and climate? Grasses that the overflows of the Mississippi cannot drown, and grasses that will not starve on poor hill-sides where the chemist cannot find any plant food? We have grasses that neither heat nor cold can stop growing. We have grasses for hay, for pasture, for wet land, for dry land, for rich land, for poor land, for clay land, and for sandy land. There is no condition of soil that we have not a grass to suit. There is no excuse for a single bare place on any farm in the South, for *Lespedeza* will grow everywhere. If one beast in the South for one day goes without enough grass to satisfy its wants, either winter or summer, it is not because the land will not grow it, but because man does not cultivate it. Because the people of the South yearly spent millions of money for commercial fertilizers, we must not conclude that the land will not grow sufficient grass,

almost without any expense to the planter, to support cattle, hogs, sheep and horses to make manure enough to almost do away with the necessity of using commercial fertilizers. Nowhere else are good lands so cheap and where the expenses of the farmer are so small as here in the South. Yet nowhere else in the world is so much land being ruined by the plow as here. Every State has its thousands of acres on the eve of being ruined. Nowhere else is there so little land subject to waste from cultivation, in comparison to the level land, than here. Nowhere else in the world is there less necessity for the ruin of the hill land than here. We have more level land than we can work, yet instead of our hills being preserved for pasture, for fruit and timber, they are plowed from year to year until ruined. How long this is to last depends on the course of our leading farmers. That it has lasted long enough, no one will deny, but how to stop it and give the grasses a chance to make the waste places once more produce in abundance, is one of the problems of the hour, and for which we have assembled to solve.

That our annual cotton and tobacco crops would bring as much money in the aggregate if they were one-third less, their history for the last twenty-five years will show. One-third of the land devoted to grass would improve it and give us as much money, even if we neither pastured nor cut the grass. But the grass would bring us an annual income, enrich our land, increase the yield of all crops per acre, and consequently make us prosperous and happy.

Some will say this is impossible, that we must go on in the old way, neglecting stock and grass, and wearing out our lands; that we need money, and that nothing will bring it so quickly and easily as wheat, cotton and tobacco. There are, I know, instances without number where these crops have made money for the planter, but that they have paid the country at large as well as the grasses, it would be difficult to prove.

There is no good reason why every farmer in the land should not raise grass enough for his own use. We cannot excuse ourselves for neglecting the grasses because we cannot raise blue-grass, for there are grasses adapted to the soil and climate of Georgia, just as valuable as blue-grass.

The misfortune is, we look upon our grasses as nuisances. Bermuda, one of the most valuable grasses we have, is by most of us considered good enough to hold the levees of the Mississippi in place, but not good enough for our fields and pastures. Its great tenacity of life, which should recommend it, is made a serious objection. It is perennial, nutritive, relished by all kinds of stock, and everything feeding on it fattens rapidly. It makes good pasture in the extreme South every month in the year. When cut and dried it makes a most excellent hay, and is more profitable than a crop of cotton. But as the floods cannot kill it, nor the hot, dry summers of the South, nor tramping, nor, in all cases, plowing, we are warned to keep it at a distance. Its merits are considered faults. For the same reasons we could find fault with blue-grass. In many instances it has been turned over in the spring and the land cultivated in corn without killing it.

But I must confess that talking does not always effect revolutions, however wisely it may be done.

Example is sometimes, if not always, better than precept. When a problem is demonstrated before one's eyes there is no disputing it. Every man wants to do the best he can, and when he is shown a new way, that is decidedly an improvement over the old one, or what he has been used to, he will adopt it. Then, let some take the lead, and adopt new ways, make use of the grasses, and stop the leak that is ruining our land.

NOTES ON THE GRASSES.

BY G. E. MORROW, PROFESSOR OF AGRICULTURE, UNIVERSITY OF ILLINOIS, CHAMPAIGN, ILL.

Years ago I learned that one does well to be very careful in criticism of the practice of reasonably intelligent farmers in a region of country with which he is not thoroughly familiar, and

that suggestions of change in methods should be made with caution and modesty. Much of the severe criticism of American agriculture as a whole, and that of any given section, comes from men who have little knowledge of the circumstances and conditions which have brought about the peculiarities criticised.

It is a common failing of farmers, however, to be overly conservative, and to not readily recognize the changes in circumstances which dictate a change in practice. Various topics in the programme indicate a recognition of changed conditions for Southern agriculture, and so, although my experience in grass culture has been north of the Ohio, I cheerfully comply with the request to take part in the discussion.

It seems to me clear that the interests of the agriculture of the Central Southern States will be greatly advanced by giving increased attention to the breeding, rearing and feeding of a largely increased number of farm animals—horses, cattle, sheep and swine. Grass is the natural food of all these animals. For the growing animal it should be the chief food during all the year, except in winter, and then hay, or dried grass, should be a prominent part of the food. In no other way can a given increase in the weight of animals be so cheaply secured as when they are grazing good pastures. Increased attention to grass culture must precede or accompany any considerable increase of attention to stock breeding.

Grass culture and the consumption of the grass by farm animals is not only dictated by the fact that there is a good prospect for fair direct profit in the sale of animals and their products, but also because this is the best practicable method of maintaining or improving the condition of farm lands. I believe in "commercial" or "chemical" fertilizers. Their use is often wise. But for much of the South I believe no manuring of equal value can be so cheaply done as that secured by the growth of grass and other forage crops; their consumption on or near the land; the return of the manure so made, and plowing under more or less of the growing crop. The addition of a good quantity of decaying vegetable matter to the soil seems

to me one of the most desirable things to secure for much of the land, of West Tennessee for example.

It can hardly be claimed that any part of the Central South has the best possible climate for the grasses. But surely there need be no argument to show that Tennessee can produce fine grass. The all-sufficient statement is that it does do this in different places. Many other sections can do likewise if the farmers will. Where cotton, corn or wheat has been grown as the leading crop; when live stock has been a minor feature, grass has been little valued—sometimes even considered an enemy. Energetic work and some faith in it will make it easily possible to grow good grass in many parts where now very little of it is seen.

Grass culture goes naturally with small grain growing, or grains on grasses. In practice, it probably will be found best to sow the grass with the grain, either in autumn or the very early spring. When there is probability of drouth in the fall, I prefer the early spring sowing. With us I find no crop so suitable with which to sow grass as rye—whether this is designed to be pastured or kept for the grain alone, it may furnish most excellent pasturage both in fall and spring and then give a fair yield of grain. We do not find oats near so well suited as a companion for the grass. Wheat does fairly well.

The mention of rye for pasturage suggests a reference to the great value of some of the annual grasses, sometimes cultivated chiefly for the seed, or hay, or even for pasture. The millets take high rank here. They mature so quickly, yield so abundantly, and, properly managed, make such admirable winter food that it would seem their more extended culture would be advisable. As helps, especially in time of drouth, some such crop as millo-maize, sorghum or common field or the larger varieties of sweet corn may well be grown. The quantity of really excellent food produced per acre by corn drilled fairly thick in rows three and a half or four feet apart and well cultivated is enormous. Sorghum is much liked by many when grown in the same way. It may be that millo-maize is superior in the South. Provision for a reasonable quantity of some crop of the kind for use if the pastures fail because of drouth will make the

keeping of live stock in good condition during the summer always favorable. If the favorable weather makes such use unnecessary, a supply of excellent fodder for use in winter can be had.

As to varieties of grasses I speak with hesitation. In many respects blue-grass, *poa pratensis* (with profound respect for the great State, I must insist it is hardly fair to call this Kentucky blue-grass), is unsurpassed as a pasture grass. Nutritious, palatable, starting to grow early in spring, continuing late in the fall, comparatively little injured by frost, making an admirable winter pasturage, little injured by trampling or grazing, hardy, steadily growing better with age, making an unsurpassed sod. It has one lack, it quits us in midsummer to a good degree. For permanent pastures I prize it highly. It is not desirable in a quick rotation.

Timothy, *phleum pratense*, is still the great American grass for meadow and pasture combined, and I believe it will do fairly well in regions of the South where, as yet, it is little known.

Orchard-grass, *dactylis glomerata*, is a grass which steadily grows in my good opinion. It grows in bunches, never making a compact sod, and in good soil is rather coarse, especially if left to mature. But it grows very rapidly, starting early in spring, and quickly after being cut or eaten off, and stands drouth well with us. It yields a great crop and I think worthy of more attention than it has received. It may well be that some grasses native to the more Southern parts of the country will prove of great value when fully tested. My personal knowledge of them is too slight to make it wise to express opinions.

Clover may here be classed with the grasses. In practice it goes with them. Whenever it will do well it is invaluable. It makes excellent pasturage; difficult to cure, it is, if well made, admirable hay, and probably has no superior as a green manuring crop. With us we usually find it best to sow it in connection with timothy, of course sowing in the early spring. Either in rotation or as a part of the mixture for permanent grass land, I think very highly of it. The plan of mixing

grass seeds of different varieties, also clover, is much less practiced in this country than in Europe. It would seem especially desirable when there is doubt as to which variety may be best.

If farmers are willing to give some extra care and labor to it when young, in the way of keeping the land clean, Lucerne or Alfalfa may be well worth trying. With us it is very hardy when well established, but we do not count it equal, all things considered, to clover which does well with us.

As to culture, I only take time to say that grass and clover seeds are small, the plants tender when young. They ought to have a fair chance. They should not be deeply covered. The soil should be pulverized. I have never known a liberal top-dressing of finely divided barnyard manure to do harm, but often much good. A light mulch of straw or stalks in midsummer is often helpful against drouth.

HON. CLINTON BABBITT,

of Madison, Wis., followed Prof. Geo. E. Morrow in discussing the grass question.

Owing to the excessive modesty of Mr. Babbitt, which is his chief fault, and the unfortunate circumstance that our reporter did not arrive on the ground until he had nearly closed, it is impossible to present his speech in full as we very much wished to do. Mr. Babbitt is Secretary of the Wisconsin State Board of Agriculture, and there is not a man in the United States better fitted for such a position. His services to the State of Wisconsin have been invaluable, and were it not for his modesty, and the Republican party, he would have been Governor long ago.

Those who were so fortunate as to hear his speech told us that before he entered the grass discussion, he said he had come to Jackson, leaving all prejudices behind, and to learn, if possible, rather than to criticise the people of the South or Southern methods of farming. He thought the interest of one section was the interest of all, and that nothing was so much calculated to wipe out sectional feeling as such meetings as the present. He advised the farmers of the South, who would be

happy in their old age, to cover the gullies with grass. He thought it a shame that so lovely a country should look so barren when it might as well, as not be clothed in all the beauty of verdant nature. The speaker was in a very happy vein and interspersed his address with many humorous anecdotes that were hugely enjoyed by his hearers. He at once became a great favorite with the audience, and before he left Jackson had made a hundred new friends.

THE GRASSES AND DAIRYING.

BY CYRUS H. LARKIN, OF ELGIN, ILL.

Whatever skepticism regarding Holy Writ in general, few, if any observing stockmen will hesitate to accept the assertion that "all flesh is grass," and no dairyman would object to adding, milk likewise.

Grass always has been, and probably will remain, the most important factor in stock-growing and dairy husbandry. While much may depend on the breeds of cattle, methods of manipulating milk, etc., all will agree that good forage is indispensable to success. Disclaiming all attempts at a scientific discussion of the subject this paper is presented, not claiming to discover what is unqualifiedly the best grass, but to contribute in some measure, if possible, to an investigation and exchange of experience and observation, that may aid in a favorable solution of the question of "forage plants," and in so doing will take greater latitude than would be admissible in a purely scientific discussion. Grasses are the most universally distributed over the earth of all flowering plants. There is no considerable district in which they do not occur, and in nearly all they are a leading and dominant feature of the production.

Many distinct varieties are exceedingly cosmopolitan. With many, the only essential climatic influence is moisture; it is only in very dry climates that the varieties are materially diminished.

Mr. J. Stanton Gould, of New York, as reported by the Commissioner of Agriculture, in 1873, speaks as follows of the general characteristics and habits of grasses. A practical examination of the grasses will show that they vary much in their character, habits and nutritive values. Some of them flourish on sandy or rocky soils, while they speedily perish on wet ones; others flourish vigorously in wet soils while they as speedily die in a dry one. Some will grow in alkaline soils, and, of these, some require a soil abounding in potash, another needs lime, while another can only be grown in the presence of soda. Some flourish in the brightest sunlight, while others delight in shade. Some are best adapted for hay, others useless for hay—all extremely valuable for pasture. Some lands are forced into great luxuriance by one kind of manure which will operate almost like poison on other varieties. One kind abounds in that sort of nutriment which strengthens the muscles; another, ill-adapted and, indeed, quite inoperative in strengthening the muscular tissue, will lay on fat rapidly; another, which is quite deficient in both these respects, is rich in those elements which serve to supply respiration and furnish fuel from which animal heat is eliminated.

A variety of grass possessing these qualities in a very slight degree may yet be very useful in combination with others in assisting to assimilate the nutriment contained in them with the tissues of the animal. In other words, it may act as a tonic, a dissolvent or an adjuvant.

In view of all these facts, it will be clear that in a judicious selection of different varieties of grass to occupy different localities, and to subserve different purposes, a wide field is afforded for the application of physiological, botanical, geological, meteorological and chemical knowledge.

Every variety was intended by the Creator to serve such valuable purpose. It is the business of practical agriculture to find

out what that purpose is, and to place it in the locality and under the conditions best suited to its most profitable development.

Vast areas of land are occupied by grasses that yield but scanty return, hardly paying the expense of gathering, to say nothing of the interest on investment, because seeded with a variety ill-adapted to its capacity.

True, we cannot with certainty say what grass is particularly adapted to this or that peculiar soil. One may not be able to look over the landscape and say that on this meadow or on that hill-side, or on yonder lowland, this or that species will prove more profitable than any other; but by careful observation and through just such opportunities as the one we now enjoy, we may be able constantly and surely to improve our lands and increase our incomes without trusting to blind chance.

In dairying—and I shall speak more particularly in reference to that industry, since my experience has been most in that direction—in dairying as in good stock-growing, grass in some of its varieties seems to be most natural, and hence, by some, considered the best forage plant. While it may be most natural, it by no means follows that for that reason alone it is the best, for be it remembered that we are not now dealing with the cow in her normal condition. So far removed from that estate is the dairy cow to-day, that instead of looking to her progeny for revenue, too many have criminally lost sight of that important consideration, and come to look upon each individual animal as a simple machine with which to convert a given amount of raw material into the largest amount of dairy product.

Because of the modifications growing out of this artificial condition, discussion of the best kinds of grass, as also other questions touching dairy matters will, of course, be correspondingly changed, and a matter of growing so simple a crop as grass becomes one of vast importance, and hedged about with so many questions regarding the constitution of the animal to be fed, character of land to be used, climatic and atmospheric phenomena, means, ability and judgment of the interested party,

that it becomes exceeding difficult to establish right rules, and also exemplifies the fact, too little realized, that agriculture is a science as much as law, medicine or divinity.

The crop, mode of culture, manner of curing and feeding that might be successful in my own State (Illinois), might prove a failure in this latitude. As already noted, the same holds good in localities adjacent.

The same crop and treatment that would succeed on one part of a farm may prove a complete failure on another. Especially is this true in the matter of fertilizers.

While it is generally, if not universally, conceded that barn-yard manure is best for general purposes, it is not unfrequently the case that the addition of something might greatly enhance its value. But of this branch much, doubtless, will be said, hence I leave it only to be incidentally referred to, if referred to at all. Reference will be made to grasses and plants that may be profitably used as summer or winter feed, or both. It will doubtless be readily conceded that cured feed is most valuable when it corresponds most nearly to its green condition, since in that state it is supposed to be at its best. The list to which attention is called may seem somewhat extended, and is made so, not because considered of equal merit, but as before intimated, there is such a variety of conditions that a wide reference is admissible.

Of some, to which attention is directed, I feel justified in speaking confidently, because of experience and observation under widely different conditions.

For summer feeding, reference will be made to those varieties of forage plants suitable for either or both grazing or soiling. As to the first, let me insist that no one variety is of sufficient merit to exclude all others, even though it may have a peculiar adaptation to given surroundings.

It has been demonstrated, says one authority, that if soil is prepared and made as rich as manure can make it, and sown so thickly with one kind of grass seed that the seeds will actually

touch each other, it will be found that after germination many of the young plants die out, leaving certain interspaces of unoccupied soil between the plants which live.

These interspaces may be filled ever so often with fresh seed, but a like result is sure to follow. It is impossible to fill them with the same species, as the living plants will not tolerate any neighbors nearer than a fixed distance—a distance determined by greater or less abundance of the specific food required by the particular species of grass cultivated.

If, with a given amount of food, the plants will grow within three inches of each other, as the amount diminishes they require intervals of six or nine inches, and so on. Each soil has, therefore, a capacity to bear a maximum number of plants of one variety, which can, under no circumstances, be exceeded.

If the unavoidable space be sown with the seeds of another species of grass, a certain number will grow, and the remainder will die, after germinating, as before.

The plants that grow will not interfere with those of the first variety, and the crop will be materially increased. Still there will be spaces of unoccupied soil, and the ground will not be thoroughly turfed over until from five to twenty varieties are growing upon it.

Besides furnishing a greater amount of feed, stock does much better on mixed grasses than on any one variety, no matter how good it may be. The animal tissue demands various elements for its support.

When left to choose the animal will always seek variety.

The same authority before quoted makes the following astounding assertion :

“On well managed meadows there were on a square foot one thousand seven hundred and two plants of the natural grasses and ninety-six of other plants, while on a square foot bearing but one variety (rye-grass) there were but seventy-five plants.”

If this statement be true, it is not difficult to see that much is annually lost to the country for the lack of a greater variety of plants in our pastures and meadows. It is a noticeable fact

that whenever a pasture is long used, and especially if closely grazed, a variety of grasses are found, forming such a succession as will enable them to carry a much greater number of stock than if only producing one or two kinds, by prolonging the grazing season, as the varied sorts are adapted in their growth to various seasons of the year.

Experience and observation of these facts have led to the conclusion that permanent pastures are to be preferred, not so much, perhaps, that a variety of food plants cannot be secured on newly seeded land as that they will not. To perpetuate the early setting, and to perpetuate a variety of forage, the following has been found very satisfactory: Timothy, red and white clover, blue-grass, red-top and orchard-grass.

Any one or more of these may frequently be omitted as not being adapted to the soil, or being largely indigenous to it.

With us, blue-grass, or as more commonly known, June grass, is seldom sown, as it comes in spontaneously; the same is true to some extent of red-top and white clover.

With Kentucky blue-grass, to which our June grass is most nearly allied, most of you are doubtless more familiar than I am. Some enthusiast has styled it the grass of grasses, and perhaps he is right, so far as grazing is concerned. Of its beef-making qualities there can be no question, and doubtless, all things considered, it is among the best in this latitude for dairy purposes.

But no matter how great the variety, it will frequently be found that late in the fall, or during the heat of summer, it will be necessary to supplement the pasture with something.

And this leads naturally to the consideration of those plants best adapted to "soiling," a practice which is rapidly growing in favor, especially where lands are becoming quite valuable.

Pre-eminently at the head of this list stands corn. Many of the common kinds, especially those that grow a large amount of foliage, like the large Southern, are good; but the experience of years has convinced me that the larger varieties of sweet corn have no equals.

Sown or planted at intervals, it can be used in its green state until frost, and any that may not be required before, cut for winter use.

Few that have never thoroughly tried it know its value. Sown broadcast and harrowed in, as is frequently done, is very unsatisfactory. Land intended for this use should be rich and thoroughly prepared. The seed should be put in drills, about thirty inches apart, so that it may be well worked—first with harrow, afterward with cultivator or plow, keeping down all weeds until large enough to shade the ground. Of the amount of seed to be used per acre there is a difference of opinion.

My own practice is to drop the kernels from four to six inches apart. This will give a chance for suckers, which sweet corn will always throw out if given a chance; besides, it is better if allowed to ear to some extent. If field corn is used, would put in much thicker, so that the stalks would be finer, and when fed, the whole consumed.

Under favorable conditions, the yield is very large. I have never had means of accurately determining just how much, but am confident that from five to seven tons of dry weight is sometimes produced.

The most profitable time for cutting, either for feeding green or curing, is when in full tassel, as then the nutritive qualities are most evenly distributed throughout the entire plant.

The labor of handling in its green state is considerable, but may be materially lessened by allowing it to lie a few hours in the sun before drawing from the field, which can be conveniently done on a sled or low truck.

How best to cure fodder corn is a vexed question, and so far as I know, no satisfactory answer has been given.

It contains so much water that too much time is required for exposure to the sun; besides, the effect of rains and dews are very injurious. To me, the most satisfactory plan is to cut before frost, put into small shocks, leaving it thus as long as the season will permit, then bend in bundles and stack in narrow ricks. If the season is favorable, this plan does very well,

but it often happens that the weather is damp, and in such cases more or less damage is sure to follow, and the only way seems to be to let it stand in the field till wanted.

After corn, there is no forage crop comparable with clover, and considering the results on land, especially worn out land, or that to which the application of other fertilizers is difficult or expensive, perhaps it should be placed at the head of the list. It is a most fertilizing crop, and is not inaptly termed, with snow, the "poor man's manure."

Having no long tap root, its feeders strike deep into the earth and find nutriment where others cannot go.

Since the root is large in proportion to the top, much is left in the ground on removal of the crop, to decay and add its elements to the soil.

Not only does it furnish to the soil a large amount of fertilizing matter taken from the air and brought up from below the reach of other plants, but its mechanical effects are of much account. Its decay leaves a fertile channel to the lower soil, which the roots of the other plants may follow, and by increasing porosity, make the soil more retentive of moisture.

Lands that have been exhausted by continued cropping may be expeditiously and cheaply restored to fertility if even but a small crop of clover can at first be obtained.

Add to its value as a fertilizer that it is good for pasture, excellent as an auxiliary when feed is short, and makes superb hay, and it is no wonder that with many it occupies first place in the list of forage plants. Like corn, it is difficult to secure in first-class condition when yielding a large crop, or in unfavorable weather. It should be cut without dew, when in full bloom, and cured mostly in the cock, handled with care, as the leaves are readily broken from the stalk, even when apparently quite green.

The after-growth, of which there is frequently a large amount, may be lightly fed off, or left to ripen for seed.

It is commonly sown with some other crop, either on rye in early spring, or with some spring crop. The first is much the

better way, since most sure of a good catch. On poor land would sow without other crop, early in spring.

The seed require but little covering, the rains alone being usually sufficient to cause it to take root, even on quite compact soils. It is always safe, however, to go over the ground with a light harrow or roller. One of the greatest drawbacks to clover culture is its liability to winter kill, unless protected. Little trouble is experienced where the snow lies on throughout the season, and on soil that does not heave. A light top-dressing of straw manure will largely obviate the difficulty and promote growth.

On the other hand, care is sometimes necessary, lest the first season's growth be too luxurious, shutting out the sun and air, thus preventing the roots becoming hardy and able to encounter the cold of even a mild winter.

Alongside, and close to clover, in point of excellence and general adaption, stands timothy or Herd's-grass. Its easy growth and ready adaptation to varied soils and conditions make it a favorite over a wider range of latitude, perhaps than any other single forage plant. Its modes of culture, habits of growth, and merits, are too well known to justify a lengthy notice at this time. It bears grazing well, makes excellent hay, and being fit to cut about the time of clover, is generally sown with it, affording an excellent adjunct thereto, helping to prevent lodging, and readily taking the place of it, if from any cause it is killed out. Millet is another forage crop of which much might be said in commendation. It frequently happens that from some cause, a spring crop may fail, when the season is too far advanced to permit of reseeding, or a piece of ground could not be fitted until late. At such times this crop is very convenient. Requiring but from fifty to seventy days to mature, withstanding drouth remarkably, it may be sown at any time from May to August, with reasonable safety. It grows from two to four feet in height, has a profusion of leaves, and is much relished by stock; and experience has shown that when judiciously fed, is a valuable crop. The curing is much like timothy, care being had not to overdry it—should be cut quite green—grows on a variety of soil, but does best on a dry, rich and well pulver-

ized one. From one-half to three-fourths of a bushel of seed is required per acre. The cow pea is attracting some attention as a forage plant. A recent writer in the *American Agriculturist*, says that it yields from four to five tons per acre of excellent fodder.

A recent trip to the Pacific coast has satisfied me that alfalfa may be made a very profitable crop, both for grazing and for hay. It seems particularly suitable to sandy and unproductive soils, especially where the rainfall is scant, though it responds most bountifully to the application of water from the irrigating ditches of California. Six to eight tons are frequently taken from an acre in a single season by frequent mowings and plentiful waterings. But while benefitted by frequent flooding, it withstands drouth remarkably, its long tangled root striking deep into the earth, thus obtaining moisture far below the reach of ordinary plants.

Recent experiments in Florida clearly demonstrate its adaptation there, where no other valuable grass could stand the heat and drouth of the long summer. Like other small seeds it requires a finely prepared seedbed and a light covering of earth.

It should be sown at such season as will insure moisture sufficient to germinate the seed.

Mr. William Crozier, of Northport, Long Island, says he considers it one of the best forage crops, especially for milk cows and breeding ewes.

Mr. C.'s plan is to sow broadcast, using fifteen or sixteen pounds of seed per acre. In his latitude (New York) he finds the best time to sow is about the first of May. E. M. Sargent, of Macon, Ga., writes: I consider alfalfa the most valuable forage plant that can be raised in this country, that is in the cotton belt or north of it, if the land is sandy, without clay subsoil too near the surface. In the summer of 1881, when everything else here was parched with drouth, this alone was prompt in its maturity for the mower. Bermuda grass, a rank grower, very tenacious of life, even under unfavorable conditions, is as yet of uncertain value.

Reference might with propriety be made to the grasses of our Western States and Territories. The mesquite, buffalo and gramme have remarkable adaptation to the wants and uses of the Western herdsman. Too short to be readily cut with the mower, they mature on the ground when grown, retaining their nutriment even when covered with snow, making excellent winter pasturage, and in those western regions where cattle growing and beef making are leading industries on a large scale, have great value.

The list of grasses might be greatly extended, but it would only make more evident what is already clear to every thinking mind, that no absolute rule can be laid down as to forage plants, either for pasture or winter feed. Every one must be governed by the circumstances that surround him.

While it is undeniable that there is a great difference in the adaptation of soils to the production of food for dairy purposes, it is not true that the dairy region is limited to any peculiarity of soil. He must be a poor farmer, indeed, that cannot produce on any soil of moderate fertility, some food adapted to the needs of the dairy.

One very great error has been the practice of sowing the same varieties and under every circumstance. By observation, experiment and exchange of experience, we are learning a better way.

The practice of confining pasturage to swamp lands cannot be too severely condemned.

Such lands, if properly understood, make good grazing, but if not, satisfactory results will scarcely be obtained.

In closing, let me remind you of the wise saying, that he is a benefactor of his race that makes two spears of grass grow where but one grew before.

ADVANTAGES IN THE SOUTH.

BY M. B. HILLYARD, SECRETARY SOUTHERN IMMIGRATION ASSOCIATION, NEW ORLEANS, LA.

Mr. Hillyard has been very closely identified with the Southern immigration movement, and he spoke very intelligently about the advantages in the South.

Addressing himself to the topic of immigration, he said that, preliminarily to some considerations to induce immigration South, he would make a hurried review of the great migrations of the world, in order to show that these were not westward, nor on parallels of latitude. That so much has been said and written to induce people to settle in the west by constant assertions that the world's history is full of movements west and on parallels of latitude, that it was worth a somewhat elaborate excursion into history to refute the fallacies. Commencing then, he adduced the march of the vast multitudes out of Egypt, north, to the promised land, on the east side of the Mediterranean Sea. He spoke of Alexander the Great moving south and east in his great conquests; of the flight of the Roman eagle, regardless of clime or compass, in the indiscriminate rapacity of its scowies — south to Africa; east, across the Adriatic Sea to Greece; north to Gaul and Great Britain. These mighty events, before the Christian era. He then spoke of the leading movements of mankind since then. Said the irruption of northern barbarians in the fifth century had wrought the most enduring transformations in history, which still continued, and would last through all time; that they had literally transfigured Europe. Coming down he spoke of the Saracen invasion of Spain—the long occupation thereof; the glories and greatness of Spain under Moorish sway. Down the centuries, later, he showed how England, for long years was deluged by the Northmen, until the island was finally divided into two sways; then, at last, in peaceful amalgamation, both races were ruled, now by the Danish, and then by the Saxon line, until William the Con-

queror came. (In connection with England, he spoke of the conquest of Scotland.) Later came the crusades, ranking among the most important movements of mankind. He showed how the Mediterranean—the cradle of the old civilization—became again, that of the new; of the growth of those great nations and fair cities on its shores. He then showed how the East Indies and Japan (particularly the former), were, for centuries, the great goals of European ambition; that England, Spain, Portugal and Holland waged long wars, spent vast sums of money therefor. He showed how Spain, so long the mistress of the world, owed her greatest cause of downfall to her vast depletions of people, in populating South America. He commented on the fact of how the West Indies and Africa were choice arenas of colonization for various nations for so long a time. He showed that long after settlements had been made to the (now) United States by England and Holland, they were treated with comparative inconsideration, while other colonies were the pets—Barbadoes, etc.

He showed that the United States (the American colonies), owed their expansion to the three great causes; the persecutions of the Protestants—the Puritans thus populating New England; the pushing of slavery, by England, on the long and vainly protesting South, in order to enrich the nobility and wealthy men who were engaged in the profitable slave-trade in Africa; and to the persecution of Huguenots in France. He said America was long rather an asylum than a coveted goal. He then told of the flight of peoples in various centuries from England to Holland, under Mary; under Charles I, from France to Switzerland, Holland, and elsewhere, and of what vast moment they were. All these and others, unquestionably the most signal tides of people which ever swept the shores of time, were everything rather than west. And coming to later days and our own time, he said that, now, the West of the United States had its most portentous opponents from quite another direction than to the West; that Australia was the greatest wool-producer of the world; produced more gold than any country but the United States, was looming up as a great exporter of slaughtered mutton; had a million and a quarter of European inhabitants, and had many other aspects of progress—in pro-

duction of wheat, etc. He then alluded to British India—her immense population; her almost incredible progress in wheat production; how large a number of English were there; how large a proportion of the English army; the development in railroad building; the immense sums of English capital there embarked, and that she had plucked—probably forever—the brightest jewel from the forehead of the West—supremacy in wheat. He spoke of France in Algiers; of her going to war for territorial aggrandizement in China; of Germany and Spain ready to fight for territory; of France and England almost embroiled in Egypt; of Russian aggression East; of England's seizure of Burmah; of various schemes of various nations in Africa now. He thus showed that neither in the past were the greatest movements west, nor are they now.

He then turned to the question of movements on parallels of latitude, and showed its hollowness. Until the acquisition of Alaska no one could have moved on the above line from Great Britain, and got to the United States. The most southern point of Great Britain was north of the highest point of the United States (proper). An Englishman ought to seek the frigid region of Hudson's Bay. A Spaniard ought to settle well north—for the bulk of the Southern States were south of Spain. A Frenchman ought to seek New Foundland. A North Italian, New England, etc. He showed the absurdity of talk about parallels. He showed how they ran across Europe—through Russia (in part), the parallel was through Italy across Adriatic Sea, on through North Spain, etc. While the Sea of Azof was locked in ice in spring, the oranges were blooming on the south side of the Alps, Russia, Italy and Spain were in the same parallel. England was north of most, parallel with much, of North Russia. She was colonizing in Australia, India and elsewhere away south. Spain colonized herself to death, south, etc.

He then spoke of climate. Showed how little latitude had to do with it. There were England and the Shetland Islands. They had (in much) the type of climate of southeast Spain on the shores of the Mediterranean. There was southern Russia, away south from England—that had an execrable climate—

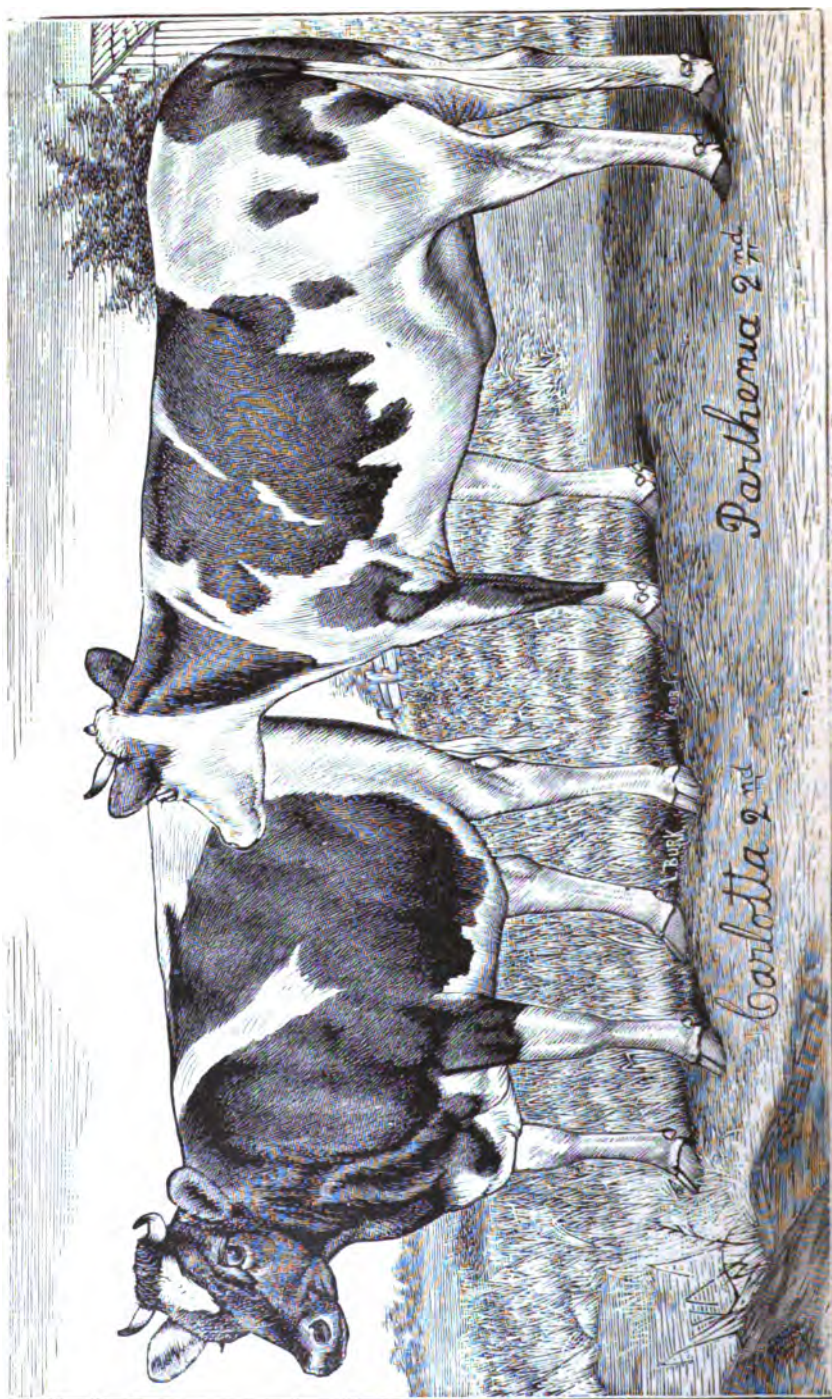
witheringly hot in summer, drearily frigid in winter. There were the Azores—west of the southernmost point of Europe—perfectly delightful in climate. There was Spain; part of it almost unendurably hot in summer, and intolerably cold in the same quarter, in winter; and there are points in the southeast, on the Mediterranean sea, where the climate is like a lovely spell. So much for Europe. Going way south, he showed the character of Australia, in part, and of the Bahamas. He showed the various climates in South America, where altitudes alone, made the differences; how they ranged from a Tophet-like heat in the lowlands, up to Alpine growths, to total extinction of animal and vegetable life at the summits of the Andes. He then showed the intermediate belts. The tropical fruits and flowers at one altitude and its incomparable loveliness of climate; a few thousand feet up, different (colder) climate, fruits, flowers, trees; higher still, the cereals and trees of colder climates. He spoke of the different climates in the same parallel, but in different altitudes, of the Alps—on the southern slope, the olive and the orange—high up the awful nakedness and frigidity of eternal ice and snow. Here it is seen that South America and Switzerland have the same climate. Are they in the same latitude? England is quite ten degrees north of the same climate in southeastern Spain. Holland is right east of England. Her climate is awful. The cold from the North Sea sweeping over her level, makes the climate very severe. England's climate, a little way due west, is lovely. He showed how many of the hottest climates of summer are the coldest of winter—Russia, Spain, the valleys of Switzerland, etc.

Coming to the fourth, he said it was absurd to criticise even on the subject of heat. Russia was hotter in summer, as were Minnesota, Dakota, much of the north and west. To the old-time assertion that slavery was a necessity, because the negro alone could stand field-labor in the South, he instanced that tens of thousands of poor white men, who had never owned a slave, had done effectual work. Since the war a much larger proportion of white men had been in the field; while tens of thousands of Europeans have done field-work all these years—particularly the Germans in Texas—with no complaint. That, really, the southern summer's sun was more pleasant than that of

the North and West, and sunstrokes were almost unknown. He then turned to the South more particularly. Drew a picture of her prosperity before the war, her condition thereafter, her situation now, and foreshadowed her future. He showed that the value of farms in 1860 was \$3,088,179,135. That the number of her live stock in that year was 37,181,619. That their value \$610,305,082. That she was then the great live stock center of the United States. That she then raised 360,116,333 bushels of corn, and nearly thirty-three bushels per capita of population. That she raised over four bushels of wheat per capita—45,250,055. That she raised 28,482,359 bushels of oats, or two and a half bushels per capita. That she raised 39,231,936 bushels of sweet potatoes, or three and a half bushels per capita. That she had nearly two head of swine per capita, or 18,241,218. That she produced 5,387,052 bales of cotton or 221 pounds per capita. That she raised 187,347,382 pounds of rice, or seventeen pounds per capita. That she raised 750,179,898 pounds of tobacco, or thirty-one and three-fourth pounds per capita. That she made 70,623,427 pounds of butter. That she sheared 12,688,887 pounds of wool.

The war came and passed. Its effects were such as no civilized country furnished a parallel to. He knew not how to characterize it, except to call it a *paralysis of agriculture*. In all other civilizations, after the war, the farmer returned to the plow, the artisan to his trade; but the negro (largely the artisan, and wholly the agriculturist) did not, at once, return to his vocation, The Southern white man was uninured to and ignorant of agriculture. His teams and agricultural implements were gone. He had no money. He was forced to buy everything on credit at the most ruinous prices. Cotton was high in price, and almost every one raised cotton, and bought corn, pork, hay, flour, etc., at high prices. Cotton fell in price, and engulfed the whole South in virtual bankruptcy. From that stroke the South has not yet recovered. The merchant wants cotton and dictates its production, and all these years the South has been raising cotton and buying breadstuffs of the merchant at ruinous prices; the latter buying from the West.

In an estimate of the shrinkage of values of real estate in 1867, as compared with 1860, Virginia had lost 27 per cent.;



YEARLINGS—PROPERTY OF EUGENE SMITH, NASHVILLE, TENN.

North Carolina, 50; South Carolina, 60; Georgia, 55; Florida, 55; Alabama, 60; Mississippi, 65; Louisiana, 70; Texas, 28; Arkansas, 55; Tennessee, 18. But this did not show the true status, as gold was at a high premium then, and the estimate was on the basis of greenbacks.

He said that the future of the negro, to seize his opportunity to own the South, had demonstrated, irrefragably, the improvidence and unthrift of the race. Had he been of any other race he would have purchased the South. He could have bought it at his own price, and on credit, but his chance to do so was forever past.

He said he would not compute the loss to the South in her billions of money in freeing the slave. The freedman was here. He was the most portentous of all threat to Northern and Western prosperity. The competition of the ryot of India; the pauper labor of Europe, with the above sections, was as nothing compared to the cheap labor of the freedmen of the South. He could be hired at from ten dollars to twelve dollars per month and rations, say fifteen dollars per month. He could go into the field or the mine. He knew not how to "strike," and was utterly dependent and tractible. His labor was largely surplus; and, if necessary, even lower rates could be dictated to him; for inasmuch as there is enough negro labor to raise all the South needs, the immense number of white laborers (who own the soil) who have learned agriculture by the lesson of the war and the bitter exigencies of their condition thereafter, make the negro labor a surplus just in proportion to the accession in number of whites to the ranks of agriculture. And then, if Eastern cotton manufacturers clash in too close competition with those of the South, the negro woman is a reserve that will settle the matter.

The speaker then went to the census of 1870—showed how the South had fallen away off the *actual* production of 1860, to say nothing of the *proportionate* production.

He then took up the census of 1880. In some respects the South had not progressed *proportionately* beyond the product of 1870. She produced no more corn, per capita, nor wheat, not as much oats, no more sweet potatoes, no more swine. In cot-

ton her product was better—150 pounds per capita, as against 111 in 1870. She produced, per capita, about three pounds of tobacco, three more pounds of sugar, twice as much wool, and the value of her live stock was about three dollars per capita better than in 1870—in only two products of all enumerated had she bettered in proportion to 1870—those were in butter and oats. She produced seven ounces of butter more per capita in 1880 than in 1860, say, almost nothing.

Her products in 1880 compare thus with what she would have produced had she produced proportionally to 1860. Actual product in 1880: Corn, 370,862,141 bushels; wheat, 51,961,192 bushels; oats, 43,171,974 bushels; sweet potatoes, 26,276,178 bushels; swine, 16,581,223 head; cotton bales, 5,755,359; rice, 110,148,204 pounds; tobacco, 338,348,206; sugar, 169,972 hogsheads; butter, 120,609,452 pounds; value of live stock, \$360,066,883.

What the South would have produced in 1880, had she produced as much per capita as in 1860: Corn, 639,054,100 bushels; wheat, 66,865,569 bushels; oats, 40,470,726 bushels (a slight loss); cotton, 7,902,234; rice, 275,269,634; value of live stock, \$894,165,272.84. (Here the speaker's computation had ceased for lack of time to complete it.)

This showing forever sets at rest all the flummery about the superior industry and productiveness of the negro race under freedom to that of slavery. A more shallow, impudent sophistry was never perpetrated on the credulity of mankind. The population of the Southern States was 10,946,066 in 1860. In 1880 it was 16,192,332. The slave mainly the agriculturist. With all accessions of work and production, there is but a trifle more accessions of products than twenty years before. Wouldn't you farmers expect to make more corn, wheat, etc., with three boys than one.

Here are twenty-five years of the South thrown away and worse. How much money has been accumulated in twenty-five years? Why, our nation is but a little over 100 years old. In twenty-five years, at the present cost of your winter climate for feed of stock alone, would be \$8,750,000,000—eight billions,

seven hundred and fifty millions of dollars! Think of the staggering, incomputable values of our South. Think what war, impaired labor, disrupted industrial conditions have inflicted on the South.

The speaker then¹ said, notwithstanding all this loss to the South, the *residuum* of the South was rich. Some gold had been missed, but the bowels of the earth were full of it. The best potentialities of the South were indestructible and unimpaired. The soil was here still. Here were the rainfall and the climate. Slavery, the great impediment to immigration, was eliminated. Hundreds of millions had been spent in railroads. The climatic bar was proved to be an unmitigated humbug. The South was demonstrating, all through her best ranks, her appreciation of the dignity of labor by sending her best bold sons into the vocations of the artisan and the agriculturist. Even her ladies were learning the lighter branches of men's work—telegraphy, phonography, typewriting, etc. There has been a depreciation in value of Southern lands since 1860 to 1880 of \$1,245,201,214. We will say nothing of other depreciations. But that does not express it. That was the valuation when there were eleven millions of people. Do twenty years count for nothing? What makes value? Certainly one great element is *population*. What have made the values west of your land? Immigration. The South is nearly double in population now to 1860. Her land, therefore, is intrinsically as valuable now as then. But population, one sees, does not always create value. There must be *demand*. In this the South is another anomaly. With nearly double the population of twenty-five years ago, her lands are not selling at one-tenth their value. So the Western man finds land once worth from \$80 to \$150 per acre, now selling at from \$1 to \$25. The land, intrinsically, is worth far more. The only thing needed is demand. The South offers a premium, therefore, to immigration, not only of thirteen hundred millions of dollars, but of all the enhanced values of twenty-five years, the progresses and triumphs and promises of her new career, the El Dorado of the world. Was there ever such a bid to the world for immigration? If her labor will ruinously compete with the poor man of the North and West, let him take his few hundred dollars

(with which he never can hope to own a farm at the North) and buy one South, may be, can even homestead one in beautiful Louisiana, and even elsewhere.

The speaker then proceeded to sketch some of the advantages of the South. He spoke of the climate for health, saving of fuel, clothing, food for man and beast (showing, as to latter, how the winter feed for animals North and West cost over \$300,000,000 every winter), constant production, nature yielding bounty South, while extorting, with the clutch of cold and hunger North, in fruit and vegetable. As to latter, sketched the great revolution South, and the millions yielded from these, just at times when money was most needed. He spoke of early lambs and fat cattle to get the cream of the market, when it was bare and inaccessible to Northern competition. He spoke of cheaper hogs fattened twice as much on clover South than at the West, the boundless range for "mast" in nuts from Southern trees, and the proximity to consumption, of early poultry, higher prices for same, hens laying all or much of the winter, and prices for eggs. He spoke of chances for dairying, high prices of butter South, of the development, bound to come some day, to the Southern highly-bred cattle, raised in their natural condition of perpetual pasture, and superior health. He adverted to the day when the grass-flavored winter butter of the South would invade the East and North. He paid a compliment to the peculiar richness and hardness of Southern grasses, and said that if the West could have any one of the several, she would gladly give up all of hers. He paid an especial compliment to Japan clover—*Lespedeza striata*—at the request of Hon. W. A. Harris, Commissioner of Agriculture of Louisiana. He pressed the point of a most important and peculiar feature of Southern economies that the South offered the highest price of production on the very scene of consumption. That this was one of the most striking anomalies of which the world afforded an illustration. It was at least four-fold, and would well reward most profound consideration; highest price of product at point of consumption; produced on lowest priced land and fertile; with cheapest labor; in most genial climate; at lowest price of living; with health; under good government. He knew of no parallel to this combina-

tion. The Indian ryot worked cheaply, but life was a burden, under the heat and the horrors of his social condition. The West had cheap land, but the long way to transportation was a great drawback. The East was near the scene of consumption, but her lands and labor were high in price. He showed how the South was progressing—her increase of a billion in real estate values since last census, cotton manufactories, railroads, etc. He paid tribute to Messrs. Harris and McWhirter, of Louisiana and Tennessee, respectively. He showed what was in store for the West and East from Southern competition in manufacturing, cotton, iron, wool, raising beef, mutton, making butter and cheese, in raising bread-stuffs for large cities—New York, Boston, Philadelphia, Baltimore (as she once did in a measure), to be carried by water, far cheaper than products could be brought from the West.

Among advantages, rainfall, navigable streams, water powers, fish in salt water and fresh, oysters, crabs, etc., in salt waters, were to be especially considered. Each is a point worth especial emphasis. Timber resources unsurpassed—indeed, the South is the great center now of this continent. The variety and quality of woods must be studied to at all adequately impress one. This was demonstration enough of the future of the South in manufactories of all things into which cheapest iron, fuel and best woods enter. No country so unites such advantages of superiority and abundance of coal, iron, wood, cheapness of transportation, and labor, climate, etc.

There ought to be given especial consideration to one phase of the many advantages of climate, which is of especial moment, and in which, even were the South possessed of no other advantage over the North and West, there subsists the germ of industrial revolution; that is the most portentous truth that there is not the same proportion of consumption to amount or quantity of production at the South as at the North. The generality thus uttered does not impress, but if turned about and examined, it is a crushing fact. A man must eat more food, wear more clothing North, than South. Cattle must eat more. Suppose the South produced nothing in winter, even then, see in a century how much more the South could save in

these. In a year, one winter in the South, could it be sent North, at present stage of population and industrial status, would be worth \$500,000,000. Contemplate this! All this outside of consideration of health and comfort.

A most remarkable complication of advantages was in the fact that the richest iron and coal, and of the utmost abundance, cheapness and accessibility, were near the richest land for agricultural purposes—and these practically inexhaustible. Stupendous blessing! Rich coal lands in Pennsylvania \$1,000 per acre, and 1,000 miles from fertile Kansas, Nebraska, for corn, wheat, pork, and with long railroad transportation; coal and iron lands of Alabama, Tennessee, Kentucky and Arkansas at \$1 per acre and up, and from richest river bottom lands almost no distance to two or three hundred miles, at a few dollars per acre, and water to bring the products together. Some one says there is enough land in the Mississippi bottom and of the State of Mississippi alone, to produce the cotton crop of the world. Think of the import of this advantage.

Cheap lands and low taxes. Lands formerly worth \$30 to \$150 per acre are now from \$3 up. Taxes a bagatelle—most States prohibiting even as much as two per cent. assessment on valuation and valuation very low, farm lands often assessed at \$5 per acre. A fine farm of 1,000 acres would often not cost the owner \$150 for taxes.

Varieties of products in general, everything the South can raise, much the North cannot—cotton, jute, silk, better wool, tobacco, sugar, rice, etc.

The South has heretofore raised nothing but cotton; but wait awhile until we get into the above mentioned diversification and raise all of our own corn, oats, hay, rye, wheat, barley, buckwheat, etc. The West, in a large part, must be agricultural or nothing. In some parts they can't raise corn. But the South can be and will be agricultural with unspeakably larger diversifications than any other section can be, and manufacturing too. Thus the South combines the advantages of the West and of New England, and many more than both, with cheapest lands.

An advantage of great import is Southern transportation. Many of the most important railroads built North and West with inflated currency, iron or steel rails \$120 per ton, high-priced cross-ties and labor, and grades are severe, and must always cost much in wear and tear, while snow blockades, etc., add expenses. South, the roads built since the war are mainly of cheap steel, with advantages of low grades and few expenses for winter. But above all, the rivers are so abundant and penetrating that river transportation must protect the South against the extortions of railroads possible to much of the North and West.

The compulsions of fashionable conventionality do not hold such sway here, as at the North and West. Most everybody is poor, confesses it, puts on no airs. People are not straining the pocket-nerve to hold up the head and keep up appearances. This is a very great matter.

A tremendous advantage is in the fact that the world has faith in the South as the most inviting field for investment. Her growth almost surpasses belief. Europeans and Americans are buying lands by the million acres. Everybody sees (who thinks at all) that the South is destined to be the great theater for the manufacture of fabrics of cotton, wool, iron and wood. Great railroad magnates like Huntington and Jay Gould, of this country, and Baron Erlanger and Count Telfener, of Europe, are investing capital by the hundred millions of dollars. Since 1880, nearly 11,000 miles of railroad have been built in the South, and one hardly ever fails to learn every day of new roads projected or incorporated. The capital invested in railroads and equipments, in 1880, was \$679,800,000. It is now over \$1,250,000,000. Manufacturers from Europe and the United States are visiting the South, and investing in one and another industry. In two years manufacturing industries in the South have engrossed nearly \$200,000,000.

Florida has nearly doubled her population in five years, in Texas and Arkansas the cars are crammed with immigrants. Every Southern State is feeling the new life infused into it by foreign influx. Until of late the South has felt nothing of this. The West had a monopoly. Now it is becoming more and

more certain, that the South is to surpass the West in the quality of her immigration, because the immigration now moving South is in a great part wealthy or well-to-do Northern or Western people, who bring far more capital per capita, than foreigners, as also better culture and more congeniality, only let people settle in colonies and always buy the best land. It is a great mistake often to buy poor land because it is cheap.

Thus with all that had been and more than could be said, could it be doubted that the South was more intrinsically rich than before the war? If under slavery with no railroads, no idea of mineral wealth or manufacturing, she was worth in farm values in 1860, \$3,088,179,146, what ought she to be worth now with nearly 20,000,000 people? And yet her lands are assessed at probably less than in 1860.

The speaker touched upon some threatening aspects to the West, of the world and of the South. France had laid a duty upon Western wheat, Germany expels her pork, and England was meditating against her butter and cheese. The latter, through Australia, and India had forever (most probably) expelled the wheat of this country. The English farmer must have lower-priced land to rent, and will probably, have still more cheaper wheat. The improved condition of Ireland (if availed of) would bring her products into competition with the West. The South intended to raise all her own pork, hay, oats, corn, etc. She intended to pack her cheaper pork and beef—canning it, sending it refrigerated to Europe—and mutton. She intended to raise early beef and lambs for market for Northern cities. She intended to raise all the fancy spring fruits and vegetables. She was bent on raising early wheat for early flour for the North and West. She intended to start canneries South to can oysters, shrimps, crabs, wild ducks, pineapples, oranges, figs, fruits, vegetable, etc., for home use and the competition of the world at large.

The finest sheep would be raised South—the delicate Saxony. Their fine wool would bring manufactories of the finest cassimeres South. The cotton, iron and wood factories would be South. Operatives from cotton factories would turn into the fields of New England and cheapen labor there. New Eu-

gland, losing the market for her butter, eggs and fruits, would be compelled to go back to old-fashioned ways, and raise her own breadstuffs. Now she did not raise enough to last her a month, and much of the other part of the country bought much wheat, etc., from the West. There would be many revolutions. The South intended to make her own butter and cheese, and invade the Northern market. She could beat the rest of the country in both products. Even now Tennessee creamery butter is selling in New York City at the same price as the best Northern and Western creamery. In ten years there will be many creameries in the South.

The South intended to produce the best wool, the best race-horse, the best beef cattle, the best butter cattle in the world. Nature was on the side of the South. Dumb animals did not sow nor reap. Farm animals were herbivorous, not naturally graminivorous.

The South must more and more be depended upon to maintain the balance of trade. Cotton was to be enthroned and king wheat was to lose his crown. Then the South was in the center of trade; capital worth would follow and take advantage of it. The time was when the South could not raise a penny on a mortgage of real estate; the best of all earthly securities elsewhere was in the South a drug. That would soon greatly change.

The South, for a large part of her territory, had a total or comparative exemption from insect pests. In parts the Colorado beetle was unknown. The destructive locust could not be desperate, as the South was antagonistic to its very being, its habitet being a country much dryer. The chinch-bug and Hessian fly were infinitely less destructive than in the West. He had it on most scientific authority—such entomologists as Prof. Riley and others—that the natural conditions of the South were an insufferable bar to so great a prevalence of destructive insects at the South as at the North and West.

These conditions were mainly two—the heavy rainfall of the South and the warmth of the winter. By the latter insects were not driven into hibernation and yet had not enough heat to support necessary vigor for abundant propagation.

Disastrous droughts not so abundant South, rainfall more abundant, frequently longer in summer than in winter, and generally sufficient for crop-making. Above all many crops were made before the dry season came on. Wheat, oats, corn, hay, etc., generally made before July; cotton stands dry weather well, and the best summer grasses, Bermuda, etc., almost drought-proof.

The sanctity of woman's virtue had highest regard South, and her character was never sullied by defamation except at risk of death. Her purity and innocence were characteristics of the section. And every gentleman was a ready defender of her against insult, whether of kin or not, as a mere prerogative of true manhood. No infamy was greater than for a kinsman not to avenge an insult to a lady of his blood.

He said that the desire for immigration, by the South, was a matter of calculation and policy as well as of sentiment. As to the former he said he neither believed in concealment nor affectation. The South wanted the money, brains, enterprise, improved methods of Northern men. These would put incomputable millions into the pockets of the South. As to sentiment, the South recognized the fact that we are to be one great nation, dominate the continent and to be the guiding star to all peoples. The South is the great center of the Anglo-Saxon race on this continent, and in the latitude of the grand old centers of civilization, Greece and Rome. The South welcomes the North with open hands to hospitable homes. Nothing is more beautiful than Southern hospitality except the beauty and loveliness of Southern women.

The South is a glorious, bounteous land. You tickle it with a hoe, and it laughs with a harvest. It is kissed by sunshine, and it kindly responds fruit and flowers. An eye-beam from southern beauty is planted in the genial heart of brave and gallant manhood, and it flowers into hopes that ever perfume your dreams, and its forests are golden hours—hours on which the graces of this beauty emboss their charms; the music of her voice, the glances of her eye, the tender traits of her lovely face, the ineffable spell of her pure endearments until, by her exalting influences, she sublimates one for Heaven.

PAST, PRESENT AND FUTURE PROSPERITY OF THE SOUTH.

This was the subject of a very eloquent address delivered by Hon. M. M. Neil, of Trenton, Tenn. We append the address in full, and it is worthy of careful perusal by all :

It must be confessed that in some of the chief departments of human effort the Northern section of our country has manifested a far more fruitful life than ours.

Until very recently all the clothing worn by our children and ourselves, including even the shoes upon our feet, and the hats upon our heads, were furnished to us by our Northern fellow-citizens. The same is true of all the tools and instruments of handicraft used in building our houses, and the paper upon the inner walls, and the paint upon the outer walls, and of our furniture and our carpets, and of every article of comfort, convenience, or elegance, placed in our homes to minister to our happiness.

The same is true of our plows, and hoes, and rakes, and reapers, and of every machine or implement of agricultural use.

It is likewise true of our wagons and buggies, and carriages, and of every vehicle used by us for pleasure or profit.

They have furnished us with the steamboats that ply on our rivers, with the locomotives and cars that haul freights and passengers on our railways, and with even the iron rails on which they run.

The monetary system of the country is under their control, and they can bring us riches or poverty as may best suit their own interests.

They have heaped up colossal fortunes that stagger the imagination with the power for good and for evil they confer.

Their merchants are princes, and their dwelling-places are palaces, and their houses of trade are strongholds of power.

They have builded great and splendid cities, and over the broad expanse of their country they have thickly scattered

towns and villages, and the spaces between are smiling landscapes, cared for by cunning hands, and their waste-places they have made to flourish as the Garden of the Lord.

The inquiry occurs: To what do they owe this wonderful life, these great achievements, this abounding wealth, this vast amount of stored-up energy, while we, in comparison, are poor?

It is not that we are a different race of people. Our fathers fought side by side in the War of Independence to preserve the same memories and traditions that came to us both from a country beyond the sea. The heroic deeds of Cromwell, and Hampden, and Sydney, belong to us and to them. We sprang from the same mother—Grand Old England—the most wonderful product of the ages, in wisdom, and power, and wealth.

If the difference, then, is not to be found in birth, or in race, to what is it attributable?

Leaving out of view the effect of the great civil war, which others have heretofore sufficiently discussed, I think that three causes may be assigned.

First. The North had the start of the South in an overwhelming disproportion in number and wealth when we began the race, at the close of the War of Independence. New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware and Maryland were full-grown States in the North, when the South, to match these, had only the States of Virginia, North Carolina, South Carolina and Georgia—nine in the North as against four in the South.

Secondly. The North has received an enormous factitious increase in wealth and population by immigration, which we have not enjoyed at all. It has been estimated, and I think truly, that each full-grown male inhabitant in good health, with average working capacity, adds at least \$600 per annum to the wealth of a country, as a producer. In addition to this it is to be observed that immigrants have rarely reached these shores without actual money in pocket; and considering the multi-

tudes that have come into the country since that great movement in population began these sums must have amounted to very many millions of dollars.

But in the problem there is still a third factor of very potent influence. The Northern communities were free. The fundamental ideas on which a free community rests, the underlying thoughts, feelings and principles which govern it, are of vast and incalculable importance in the acquisition of population and wealth.

In such a community labor is enthroned, and all service of mind or body is high and honorable if it adds to the wealth or well-being of the individual or the mass. In such a community education of the people becomes a matter of first consideration, because by sharpening the faculties, the individual is made more able to take care of himself. In such a community trade is a necessity because it enhances the rewards of labor. As an equally natural result follow manufactures. The concomitants of these are wealth, population and power.

Among whatsoever people labor is regarded with high consideration, to that people belong the chief blessings of life. True, it is said that labor was the primal curse. To my mind the curse consisted in man's fall from a high estate to a lower one. But surely in that lower one labor is a blessing, not a curse. It is all, indeed, that, under some aspects, makes life endurable, and to it we owe, under God, all we have. By labor the mountains have been pierced, steam has been harnessed to iron, the lightnings of heaven have been enthralled and forced to do our bidding, the stars have been weighed, and the speed of their winged messengers measured.

Unless we pause and reflect upon the subject for a time, it will be hard to realize the fundamental difference between two communities made up of precisely the same material, the one whose ideal is labor, the other whose ideal is the dignity of the individual.

The result of the first ideal I have already briefly discussed. The second is not an unfamiliar one, indeed it is the most ancient, and has produced marvelous results in the history of

mankind. This was the distinguishing characteristic of the chief nations of the ancient world. I need instance but two of these, the greatest, and whose history in outline is familiar to all. In Greece and Rome the labor of the household, of the shop, and the field, was performed by slaves. The earliest ideal of the Greek master was war and conquest, the ancient name for politics. The ancient ideal of the Roman master was likewise war and conquest; his next was the organization and reconstruction of the countries he had conquered, and the development and administration of law.

After the fall of these great powers, in the course of time the same general ideas reappeared all over Europe in a different form, that is, in the Feudal System.

It would be a needless consumption of time to even name the countries in which this system prevailed. In them all were the same general ideas and customs. These ideas were embodied in the words war and conquest. The whole country was a camp, every freeman was a soldier. In them all peaceful labors were despised. Among the well-born, the accumulation of money by labor was not to be thought of, and certainly not to be engaged in without distinct loss of caste. Property was acquired as spoil, torn from the hands of the enemy, or wrestled from the earth by the labors of vassals.

Yet these are the great nations whose lives have most deeply marked the course of time, and concerning whose up-risings and down-fallings, whose wars and conquests, whose feats and whose failures, the historian has chiefly busied himself in all ages of the world to the present.

Nor indeed have they been without great merit; nor have they been without a most distinct effect upon each of us in this day and generation.

Consider the great virtues they have illustrated and enforced by example and by precept, and the rich heritage they have left us.

Foremost among these is that greatest of manly virtues—Courage, that great quality which give a man strength of soul to stand up for his own against all the world; that quality

which individualizes him and gives him power to do and to dare, and to press down every opposition that rises in his path; which makes the man who has it the terror of the strong, the protector of the weak, and a guardian of the tender and the innocent.

They have illustrated and enforced another great virtue—Patriotism. To the ancient this was a passionate love of his native land, his hearth-stone and its altar fires. To his mind the very boundary lines of his country were watched over by the gods, and when he fought for his country, either to defend her from the assaults of foes, or to advance her power abroad, he was performing an act of religious devotion.

They have illustrated and enforced for us another great trait—constancy under peril and suffering. To the heroic mind of the ancients it was a shame to a man to cry out or to yield when subjected to pain. Regulus received the sharp iron spikes into his body without a moan or a murmur. The Roman youth, to warn the assailant of his country, and to show him the stuff Romans were made of, without flinching held his hand over the fire till it burned off at the wrist and dropped into the flames. This spirit imbued the hearts of even the children. Among the Alban Hills a Roman youth was tending his father's goats. His eye caught the glitter of arms in the distance. The King of Etruria was marching on the city. Without a moment's hesitation he bounded away to warn the people and bid them prepare against the coming foe. Down the slope and across the wide marshy plain, and over huge masses of rocks, through sluggish streams and reedy marshes, on, on, he sped: The way was long, the sun was scorching, his throat was parched with thirst, his limbs were ready to sink under him, a thorn pierced his foot—yet he pressed bravely on, and at last entered the city gate, ascended the hill to the Capitol, and presented himself before the Senate. He was just able to whisper the fatal news, and sank down exhausted—and soon died.

Nor are these great lessons all for which we are indebted to that old civilization. We owe to it a language which is the most perfectly fashioned instrument for expression of human

thought the world has ever possessed ; literature unsurpassed in delicacy of form, exactness of thought, and depth of conception ; the birth of the plastic art, by whose mighty power the marble and the canvas have been made to glow with life, and by which the rocks and the caves and the wild-wood, and the far-reaching plain, and sun and sky and sea, have all been mirrored in the heart of man and bodied forth again in forms of light and beauty.

We owe to it a system of philosophy which has been the support and the stay of many generations of men, and which has deeply tinctured our modern life, and exercised a controlling influence on our destiny ; we owe to it a system of law that has been the wonder of all succeeding ages, a system at once comprehensive and refined, practical and philosophical, and one that forms much of both the foundation and superstructure of every body of law administered at this day in all enlightened countries.

To a later phase of the same civilization we owe the age of chivalry, whence we have derived lofty respect for womanhood, that gallant courtesy toward the gentle sex, and that kindly consideration for the young, the innocent and the weak, that is so bright a crown of glory about the head of every man of true nobility of soul.

But the literature and the art, the philosophy and the law, of these great people sprung, in the main, out of the wealth and the leisure that were purchased by the practice of those manly virtues which I have heretofore discussed. These are indeed grand and beautiful monuments they have raised to their memory ; but the genius of that civilization was essentially political and heroic.

Of that civilization we of the South became the lineal heritors. Not, indeed, that it descended to us in all its rugged grandeur and beauty, but it came to us with its main features unchanged, only softened and tempered by its passage through the ages. With us there was in the same degree that passionate personality, that sense of individual dignity and personal sacredness, which distinguished the ancient Roman, and with

these traits likewise the same dauntless courage, the same firmness of soul, and the same ardent love of country.

And while labor was not despised among us as among the more ancient types of the same civilization, yet it did not hold that lofty place to which it has ever been entitled, being performed, as among our ancient prototypes, largely by slaves. Hence among us trade and manufactures did not flourish, and the multitude of industrial arts that form the chief occupation of the Northern life were almost unknown. They were not even desired.

Still the annals of the nation testify that we were not wanting in intellectual life. In the political and heroic we can challenge comparisons with any age of the world.

From Washington to Lincoln were fourteen Presidents; of these nine were Southern men. This covered a period of seventy-two years; of these, Southern Presidents consumed fifty years.

It was Patrick Henry that first sounded the alarm of freedom, and his eloquent voice was most influential in the First Congress of the colonies. It was Washington that led the hosts of freedom to liberty. It was Jefferson that conceived and framed the Constitution.

It was under the lead of Henry Clay, William H. Crawford and John C. Calhoun that the country threw down the gauntlet of battle to Great Britain in 1812, and it was a Southern General that conducted the war to a successful conclusion.

A Southern President inaugurated the war with Mexico, and to two Southern Generals chiefly belongs the credit of bringing that war to a glorious issue.

To Southern policies and Southern statesmen the country largely owes the acquisition of that vast empire that bore the name of Louisiana, and comprised all the country west of the Mississippi River except the present States of Florida, Texas, California, Oregon and Nevada, and the Territories of Utah and Arizona.

To Southern statesmen and Southern policies we are likewise most largely indebted for the acquisition of these last named States and Territories, all of which were won in the war with Mexico, except Oregon, purchased from Great Britain, and Florida, purchased from Spain.

Of the great Louisiana acquisition the emperor, Napoleon, said: "This accession of territory strengthens forever the United States, and I have given to England a maritime rival that will humble her pride."

Of it the eminent statesman, Robert Livingston, said: "We have lived long, but this is the noblest work of our whole lives. The treaty will change vast solitudes into flourishing districts, and will prepare ages of happiness for innumerable generations of human creatures."

These undisputed facts in the history of our country fully sustain the statement that to the Southern people, with the old civilization, descended its genius for politics and war. I do not mention these facts of our history in any spirit of idle boast, but to vindicate my section of the country, and to show that we have not been laggards and drones, but have in our way contributed our part to the general prosperity of the country. But it must be confessed that while this genius has shed luster upon us as a section, and while it has enriched and glorified the whole nation, and rendered it so powerful at home and abroad, and placed the existence of the country upon enduring foundations, it has profited us as a section, pecuniarily, but little. While we, during all these years, were filled with dreams of conquest, and lured by visions of power and glory, and while our statesmen were juggling their brains with refined and subtle political theories, our Northern neighbors were devoting themselves to those vast business activities, which, under their skillful management and most persistent energy, have grown to such marvelous proportions that they now overshadow the land. The result is that they are rich and we are poor.

But all this is now changing. While we will not lose "the tender grace of the days that are dead;" while there will remain with us as a sublime inspiration the memory of the heroic

past, with its lessons of courage and gentleness and courtesy; while we shall not fail in ardent love to our own dear Southland, yet a change is passing over us. The life of the section is merging into the life of the nation. We are passing from the old life into the new, from the ancient type of civilization into the modern, from the philosophical and romantic to the practical and industrial.

We have crowned Labor our King, and under his banner we intend to acquire wealth and power. Already the music of the spindle and the roar of the furnace are heard in the land. Our cotton goods and our iron products are beginning to attract the attention of the world. New industries are springing up everywhere. Immigration has begun to turn this way. We are fairly upon the pathway that leads to the new life, and are pressing onward with ever-hastening steps.

Who can foretell what the next quarter of a century will bring forth in the South? Great and splendid cities will spring up and adorn her bosom like jewels upon a fair woman, Harvests of waving grain and golden corn, and forests of blushing fruit, and all the products of the earth will grow in her fields, and will support a population numerous as the sands of the seashore, contented and happy and joyous as the sons of the morning. Nor will the busy hum of industry cease from the land. Like the din of a great army, like the rush of the winds, like the roar of the ocean, will be the whirl and roar of the mighty machinery that will perform its ceaseless labors in her borders, and the products of her factories and her forges, of her mines and her fields, will seek and find a market in South America, in Europe, in far-off Asia, and under the sultry sun of Africa, and in the isles of the sea, and her name will be great and honorable in all the earth.

THE POULTRY INDUSTRY.

BY A. A. COWDERY, COBDEN, ILLINOIS.

MR. CHAIRMAN, LADIES AND GENTLEMEN: At the solicitation of Tennessee's honored Assistant Commissioner, Col. Robert Gates, I am here to speak to you on the subject of "Poultry as an Industry." Being fully aware of my inability as a public speaker to do the subject justice, I hesitated about accepting the position. The seeming non-availability of a better man, and at the earnest request of many personal friends who are breeders of poultry, I finally consented to appear before you and present such facts and figures as I have at my command, and leave you to make your own deductions and draw your own conclusions.

From the earliest history of the human race we learn that poultry received a share of attention from the world's inhabitants. The citizens of Palestine and the Roman Empire bred their chickens, ducks and geese. As civilization made its westward march, poultry followed closely in its footsteps. China became the great center for domesticated fowls, from which we have drawn the foundation for most of our present breeds. The early colonists of our own country brought their poultry with them. To be sure, the chickens were a mongrel race, and have diffused themselves over the inhabited portions of the United States. No distinct type of fowls existed, and no effort was made to improve the natives of the soil by breeding for distinct and desirable qualities. All shades of color and all styles of architecture and degrees of constitution could be seen in every barn-yard in the country. A flock of fowls in Maine looked just as mean as a flock in Tennessee, and both of them were true representatives of all the carelessness that could be centered in domestic poultry.

As no system of breeding had obtained in those days, *in and in* breeding was the natural sequence, and the inevitable result was loss of vitality, decay of laying powers, lack of symme-

try and want of uniformity of color. And so the matter continued until about thirty-five or forty years ago, when the elephantine and voracious Shanghai landed upon this continent. Many people are living to-day who distinctly remember the furore and excitement these giant celestials created, and what extortionate prices were demanded and paid for them. Their advent ushered in an epoch of poultry exhibitions, the novelty of which attracted popular attention, and the show-rooms were crowded with a mixed throng from morning until night. The craze for gigantic fowls became wonderful, and everything useful in domestic fowls was sacrificed for size. This was the beginning of what was known as the "hen fever," the growth of which was one of the most marvelous things that has ever occurred. Long before it had reached its height it became an international epidemic, and drew together in bonds of mutual admiration and sympathy lords, ladies, statesmen, and even the capitalists of a portion of two continents, and doubtless thousands who were seriously embarrassed and who could illly afford it.

The "hen fever" finally subsided. It had been phenomenal in its rise, and was followed by a long and serene calm. The traffic in what was then called thoroughbred fowls was for the most part a wicked imposition; but though the business had been conducted very largely on the confidence plan, good came out of it in the end, for by means of it new blood found its way into every section of our country, and through it the impoverished constitutions of our domestic fowls were reinvigorated, their size increased and their laying powers restored, though their plumage remained as variegated and unsatisfactory as before.

During this calm some honest and skillful fanciers conceived the idea that, by systematic breeding, these ungainly Shanghais and Chittagongs might be transformed into more useful and beautiful fowls; and with this end in view they worked systematically, earnestly and patiently to produce, by judicious crossing and selection, a race of fowls having distinct characteristics of form, size, plumage and prolificness. Out of these crosses

came the Cochin and Brahma families, and in turn this blood was used in creating other races which have since met with public favor.

The great interest manifested in thoroughbred fowls throughout America and Europe to-day is in no respect like the craze of the time mentioned. Its growth has been gradual from the beginning, and hence healthy. A few breeders took it in hand, and by application of proper measures rehabilitated it. In doing this they solved the problem of breeding for desirable characteristics, and regained that public confidence which had been outraged by unscrupulous dealing, and thus the traffic in thoroughbred fowls was given a foothold which has enabled it to become the *largest single industry of our country*.

Let us examine into its magnitude and see if it does not merit the careful consideration and hearty encouragement of governments as well as individuals.

STATISTICAL.

Time will not permit us to wander far in foreign lands in search of "facts and figures," but we beg your indulgence for a few moments while we look across the waters to our sister Republic, France. We are informed by one of our Consuls, Mr. Geo. C. Tanner, that, as compared with America, France is not a favorable country for this class of business. The climate is mostly cold and damp, and especial attention must be paid to their housing, which, owing to more favorable conditions of climate, is not necessary in the United States. Her population is about 38,905,800 souls. Her arable land is stated to be 98,460 square miles, equal to 63,014,400 acres. The arable lands of France are divided into small farms, and these farms are cultivated very largely by their owners, and in the most economical manner possible. Wheat, barley, oats, buckwheat and other grains are raised in large quantities, but not sufficiently so to meet the demands for home consumption.

Nearly every farmer has a reserve for his poultry and has some one to guard them, and owing to the fact that the fowls are necessarily kept in limited quarters, they are subject to

sicknesses which are unknown in America, and consequently veterinary surgeons are employed to look after the condition of the fowls; and yet, in spite of all these drawbacks, it is estimated that the French farmer realizes a profit of from 15 to 50 per cent. on his fowls, and in some cases, as high as 85 per cent., though the average is placed at 20 per cent. It is an undoubted fact that the poultry industry of France is a source of wealth to her people, and the government of that country, recognizing that fact, has given it such encouragement as seemed most likely to insure for it more consideration at the hands of the farming class of its citizens. As a result of this wise policy, it is now announced under the sanction of French officials, who should be conversant with the facts, that, in addition to the regular crops raised upon their farms, those farmers who are the most progressive and industrious, realize about \$4 per acre from the sales of poultry and eggs.

England has always been a buyer of poultry and eggs in foreign markets, and France now furnishes her with upwards of 800,000,000 eggs annually. In addition to this enormous quantity of eggs exported to England by the French people, it is estimated that their home consumption reaches about 2,000,000,000; thus making a grand total of 2,800,000,000 eggs produced annually in our sister Republic. The value of the eggs exported to Great Britain annually is said to be \$13,000,000, and those consumed at home is placed at \$35,000,000. There are 58,300,000 fowls retained each year for breeding and laying purposes, valued at \$30,000,000, and the annual production of chicks, which are marketed before they are four months old, exceeds 174,900,000, and are worth in the home markets about \$60,000,000. Upon the basis of \$4 per acre the total value of the poultry industry of France is now estimated at over \$200,000,000 annually.

In view of the fact that France is compelled to import millions of bushels of grain annually to meet the wants of her people, does it not seem strange that she should be able to furnish other countries with millions of dollars' worth of food, produced by animals subsisting almost exclusively upon grain? Such seems to be the facts.

Careful inquiry reveals the astonishing fact that the United States, with a population of over 55,000,000, of whom about 22,000,000 live upon farms, and with 1,088,000,000 acres of arable land, instead of producing more eggs than is required for home consumption, imported, according to the Annual Report of the Chief of the Bureau of Statistics of the United States, for the year ending June 30, 1888, 15,279,065 dozens, and their value was \$2,677,604, or about $17\frac{1}{2}$ cents per dozen. The bulk of these importations came to us from Canada, Germany, Denmark, Sweden, China and Mexico. All come in duty free.

The announcement that the demand for this article of food exceeded the production should have acted as a fertilizer, stimulating the growth of this industry until home production attained such magnitude as to *make importations unprofitable*, but it seems to have failed to attract the attention of the producing class, as is evidenced by the fact that the importations have grown, year by year, until they have reached in value the magnificent sum mentioned above.

When we remember that the United States covers an area four times larger than all Europe; that she is justly called the granary of the world, and that her population is six times less than that of Europe, it strikes us as passing strange, not only that we do not produce all the eggs we can consume, but also that we do not furnish them to such other nations as produce less than they consume.

The New York *Evening Post* editorially referred the other day to the importation of foreign eggs into New York City. Mr. John C. Mahr, of No. 299 Washington street, is the principal handler of imported eggs in New York. When interviewed on the subject, he said: "This importing business began about four years ago, in small lots, and has been growing ever since. The eggs are shipped chiefly from Copenhagen and Hamburg, which are great egg centers. They are packed in straw, in cases containing 50, 60, or 120 dozen. Some of the lots are graded according to size, as is the custom in parts of Europe—the imported eggs, on the average, being a little

smaller than the domestic. They are sold here at from one to three cents per dozen less than the market price of domestic eggs, according to size and quality.

"In the last year, say from March 1, 1883, to March 1, 1884, I have handled about 8,000 cases of imported eggs, averaging sixty dozen to the case. I suppose that in all some 16,000 or 17,000 cases were received here during that period. The late shipments have been especially heavy, because the winter has been mild in England, and London has consequently been a poor market for imported eggs. Many which would have gone to London, have, therefore, naturally been sent to New York, where the price of fresh-laid domestic eggs reached nearly 50 cents per dozen during January. The price would have gone higher but for these importations, which have had the effect of making eggs cheaper throughout the country."

"How is it possible to import eggs and sell them at a less price than they can be produced for here?"

"Because the protective tariff makes the cost of everything higher here than anywhere else, and because of the outrageous freight charges which result from railroad pools and combinations. Recently 1,500 dozen eggs were sent by express from Missouri to this city, and the bill for their transportation, which I can show to you, was \$120.00, or exactly 8 cents per dozen. Ordinary freight rates for eggs from most of the Western States to New York are higher than the freights from Europe. There is no duty upon foreign eggs; if there was, there would be no money in their importation."

PROFITS OF THE INDUSTRY.

A facetious marketman, on being interviewed by a New York *Sun* reporter, discusses as follows:

"If I owned all the hens in this country, and had a place to pasture them in, all I would ask would be ten years in business, and I would make it very warm for J. Gould.

"Maybe you don't know, young man, that over twenty-six million cackles, announcing the birth of the same number of eggs, kept the farmers' boys busy every day last year gathering

the efforts of over thirty-six million hens? But they did. Well, those efforts for 365 days have resulted in 9,600,800,000 separate and distinct eggs, or 800,000,000 dozen, as near as I can calculate. Now, it just took 750,000,000 dozens of these eggs to supply the demand for tom-and-herries, puddings, hard and soft boiled eggs, egg-nog, and ham and eggs in this country last year, and eggs were eggs at that. I figure that thirty cents a dozen for 1883 was the average price. Thirty cents a dozen for 750,000,000 dozen climbs plumb up to the comfortable little purse of \$225,000,000. There's nothing mean about me, and if I had the handling of these offerings of the nation's hens, I'd be satisfied with a profit of two cents on a dozen.

"What would be my little divvy? Well, if I haven't forgotten what old Daboll drummed into me, I make it out that when the old year dies out I would lug home something like \$15,000,000 clean and slick ahead of the game. Ten years of that, and I think I could sit down with the boys and stay with as heavy a jack-pot as any of 'em."

"What would become of the other 50,000,000 dozen?" asked the reporter.

"There you are again!" replied the marketman. "If I owned all the hens, there's another little item that would help me to keep from worrying about the punctuality of the rent and the infallibility of the gas meter. Last year must have been a good one for people visiting in the country, for folks broiled, fricasseed and roasted something like 60,000,000 chickens, young and old. That used up the little balance of 50,000,000 dozen eggs. That 50,000,000 dozen of eggs was turned into chickens that gobbled up \$300,000,000 of the hard-earned coin of this realm, ciphering the thing down close at 50 cents a chicken. I don't deal in poultry, but from the size of the diamond pins of the ones that do, I don't hesitate a minute to say that there can't be less than five cents profit on every chicken they sell. Old Daboll comes up again and lays it down for a nickel-plated fact that if I owned all the hens in this country I would have to make two trips home from the shop at the end of the year, for here I would have \$15,000,000 more piled in

the till to be carried away and stuffed in the stocking, and \$15,000,000 is plenty for one man to carry at one time.

"So you see what a nice nest egg I'd have at the end of ten years. And you'd hardly believe that New York city would chip in about one-thirtieth of the whole pot every year, would you? But she would. Last year it took 25,000,000 dozens of eggs to satisfy her, and she paid \$9,000,000 to get them. New York State only keeps hens enough to lay about 8,000,000 dozen, and so, of course, we have to go knocking around all over the country and part of Canada, to keep up with the cry for eggs. It would take all the eggs that New York, New Jersey, Pennsylvania and Massachusetts are responsible for to supply this city with all the eggs she wants. The 25,000,000 dozen eggs used here last year, if laid in a single line, one after another, without a hair's space between them, would reach from Boston to San Francisco. I tell you, there's a big thing for some one who can get a corner on hens."

The following statement of one person's poultry business for six months, beginning January 1, 1884, was furnished for publication in the *American Poultry Journal*:

Number of coops shipped during 6 months...	238
Number of chickens shipped during 6 months,	704
Total amount received on 704 chickens.....	\$3,501 80
Average on 704 chickens, each.....	4 97
Eggs sold during the same time, from January 1 to July 1, 1884, 472 settings, or 6,136 eggs.	
Amount received for eggs.....	2,150 00
Average price per setting.....	4 58
Total amount received for chickens and eggs for first 6 months, 1884.....	5,651 80

He says: "I do not wish to convey the idea to any one that this is all profit. The expenses were about one-half. I write this to show you and the readers of the *Journal* that a man may and can spare a portion of his time outside of any business, and devote it to the raising of poultry, and realize both pleasure and profit therefrom."

We cull the following items from the *American Poultry Yard*, where correct accounts had been kept for a twelvemonth:

With 120 fowls, total receipts for eggs and dressed chickens, \$382. Cost of feed, \$211. Profit, \$171, or near \$1.50 each fowl, with 132 birds to commence the next year with.

With 48 fowls, received for products sold, \$170. Cost of feed, \$82. Profit, \$88, or about \$2 per head—50 fowls and chicks carried over.

With 64 fowls, received \$267. Cost of feed, \$152. Profit, \$124, or about \$2 per head—70 fowls left on hand.

During a trip through a portion of the Mississippi Valley, last summer, we stopped at a neat farm-house where there was every comfort and luxury of a home. Among the members of the family was a daughter 18 or 19 years old, who, during the evening, entertained those present with piano and vocal music. In the morning we were invited to see the work in which the young lady was engaged. We accepted, and found one of the most complete and successful fowl-raising establishments we have ever seen. At a small cost, a number of small inclosures, with a capacity of forty fowls each, had been made. There was a little house in the center of each inclosure. The whole cost of yards and houses could not have been more than \$200. With this investment, and an incubator and brooder, she was raising a thousand chickens, and a perfect swarm of ducks and turkeys. They were all in perfect health.

One of the breeders of fancy fowls had sent her 200 of his choice birds to be reared, for which this young lady is to receive \$1.50 apiece, or \$300. Without any unforeseen accident this little establishment will net its brave owner from \$750 to \$1,000 this season. This is better than competing with a colored cook in a hot kitchen over burning bacon and cabbage. It is better than to struggle with the needle for a fashionable living in a field already over-full, and it is a thousand times better than idleness in a shabby gentility and pretense. What this energetic young lady is doing, thousands of others can do.

The profits from a small flock of thoroughbred fowls, under the management of some thrifty housewife, has often kept the

wolf from the door. It has often furnished the children with raiment and school books, and the table with many a luxury from the grocery, and the parlor with many an ornament and comfort that a refined, intelligent family can ill live without.

The statistics for the year 1882 show that the value of the poultry product of America exceeded that of wheat, hay, cotton or dairy products, the figures for the year being, for wheat, \$488,000,000; hay, \$436,000,000; cotton, \$410,000,000; dairy products, \$254,000,000; poultry, \$560,000,000.

VARIETIES.

There are nearly one hundred varieties of fowls, including turkeys, ducks and geese, recognized by the American standard of excellence. These are all good in a general or specific way. Some are good for meat, some for eggs, some for both, and some are purely ornamental. Surely every person, however fastidious, from so large a variety could select a breed that would please them.

IN CONCLUSION.

Before closing this subject, I wish to especially call the attention of the citizens of West Tennessee to the possible advantages to them involved in this poultry industry.

Situated on the thirty-sixth parallel of latitude and between the Mississippi and Tennessee Rivers, in a rolling country where the drainage is good, with plenty of streams and springs of pure water, in a mild, salubrious and dry climate, not subject to the extreme heat of the far South nor the rigorous cold of the lake regions of the North, with a soil of sandy loam, with clay subsoil and plenty of beds of gravel, makes this the very Eden in which to produce, economically, large quantities of all kinds of thoroughbred poultry. Your means of reaching the markets South, North and East are not excelled by any section of country. With cold storage and refrigerator cars you can ship in car lots dressed poultry and eggs to Washington, Philadelphia, New York and Boston in such quantities and of such quality as to forever prohibit the importation of foreign poultry products. Every family who has an acre of land, more or less,

should keep a small flock of some variety of thoroughbred fowls. Persons of either sex who have the means, and are by nature, habits and disposition adapted to this business, can engage in the breeding of thoroughbred poultry on a large scale, and by devoting all their time and attention to it will find it a very pleasant and remunerative occupation. Fruit growers who have not sufficient land to enable them to breed cattle, sheep and horses for market, can combine poultry culture with fruit culture, and they will find that it works in well together. Do not longer waste time and money breeding dunghills. It costs no more to keep a good cow than it does a poor one; it costs no more to keep a good horse than it does a poor one, and it costs no more to *keep a thoroughbred chicken than it does a dunghill*, and the thoroughbred, with the same feed, care and attention that is bestowed upon the dunghill, will lay more eggs, and if of the Asiatic variety will dress more pounds of good, tender, juicy meat.

"There is plenty of room on top." It always pays a man to produce the best.

I thank you for your kind attention.

DAIRY FARMING.

CHAS. E. MARVIN SHOWS WHEREIN THE CREAMERY IS SUPERIOR TO THE PRIVATE DAIRY.

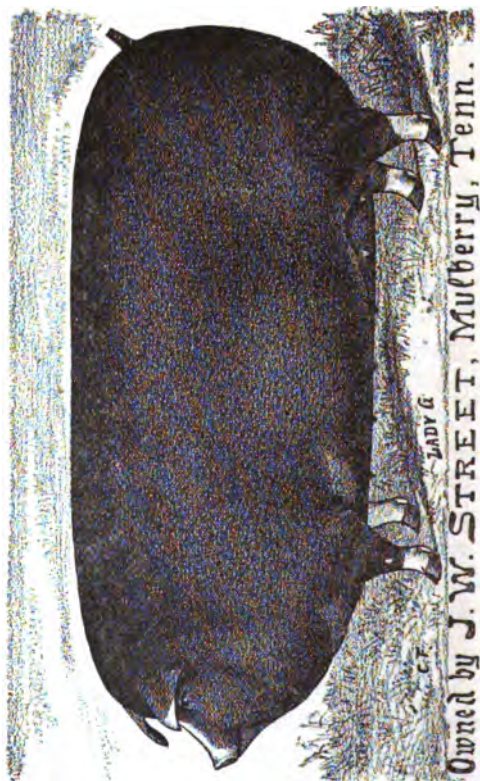
One of the addresses listened to with much attention was that of Charles E. Marvin, Esq., of Rochester, Minn.

Mr. Marvin is one of the largest producers of creamery butter in the United States, and his knowledge of what he spoke about, together with his pleasant address, secured for his remarks the respect to which they were entitled. We give the full text of the speech:

Coming, as I do, from an extreme Northern State, and a land noted for producing bountiful and sure crops of beautiful snow and ice during at least one-third of the year, it might seem almost presumption on my part to assume to advance any practical ideas on the subject of Dairy Farming. If a Minnesota man were advertised to read a paper on the subject of Wheat Farming, all would expect to hear practical suggestions, as Minnesota wheat and flour has already achieved a world-wide reputation for being of a superior quality, and a produce dealer anywhere needs no better advertising card than to announce that he handles flour produced from Minnesota wheat. Residents of Minnesota had reason to be proud of this record. All advertisements of the State interests made the fact prominent—that Minnesota was the greatest wheat-producing State of the Union. As a result, the great tide of immigration from all parts of the Union was directed toward Minnesota. Nearly all came with the one idea of gaining lands to be sown to wheat, which, with no further care, would, in a few months, produce sure and great crops of wheat, which would find ready market at prices that would make all rich in a few years. For a time the anticipations of the most hopeful seemed to be fully realized, and with every succeeding harvest the tide of immigration increased until the soil began to rebel against this profligate system of farming, and refused to yield the looked-for results. Repeated failures disheartened the most hopeful and led them to investigate into the causes and to look for a remedy whereby the gloom that seemed to be settling over every community might be dispelled. Then, for the first time, they began to discover that the depression was not quite general, but that here and there were agriculturists who seemed to thrive in spite of the repeated failure of the wheat crop. Unlike their neighbors who were just ready to declare farming in Minnesota a failure, these farmers were still hopeful, and their farms in place of having only a shabby-looking house with no fences, trees or other evidences of enlightened agriculture, seemed to the tourist like an oasis in the midst of a great desert. Good barns, pleasant farm houses, well-fenced farms, bounded by long lines of lovely shade trees, yards and pastures inhabited by well-fed, contented domestic animals, neatly clothed, in-

telligent looking children trudging beneath the shade of the trees to a neatly constructed, pleasantly located school house at the corner of the farm, in which might be found a well-paid, cheerful teacher, indicating plainly that not all had come to this land of promise with but the one idea, that of specialty or one-crop farming. A few had come understanding well the importance of diversified farming to make agriculture a success in any section. Yet had it not been for the severe chastisement received from nature by those who had presumed too much upon her ability to produce, these thrifty farmers might have remained in obscurity and the practical lessons they were now able to teach would have been lost. Necessity is the mother of invention, and no people are more ready to understand this than the American agriculturist. It was right speedily discovered that the very elements required in soil to make it produce nutritious grasses in abundance existed in the highest degree in the soil of Minnesota, and that by cultivating these grasses that the former strength of the soil could be more than restored. That an acre might be made to produce nearly if not quite double what it had originally produced; that by the introduction of domestic animals of all kinds the land would be continually benefited and farming made pleasant and profitable. Speculations in trade are ruinous to the majority that engage in them, and so is a speculation upon the great resources of nature in attempting to make her produce in a few months what should require the entire year, and especially is such a speculation ruinous to the morals and true interests of any community.

Wheat, or a specialty farming, brings with it idleness and dissipation through at least one-half of the year. To the contrary a perfect system of diversified farming brings with it constant employment of the mind and body excepting at such times as the changes from day to night, and the Sabbath bells indicate when both man and beast should rest. Diversified farming encourages industry, enterprise and intelligence. Gradually the agriculturalists of Minnesota are learning all of these important lessons. The cow has been introduced and is fast becoming recognized as the one important factor in diversified farming to make all its branches a perfect success. The beneficial results attained are easily recognized by consulting the



"Miss Duffield" (14310), Ohio P. C. Record, sired by that prince of sires, "Give or Take" (1585), that sold for \$400.00.

statistics of the State. Our stock interests have doubled and quadrupled in the past few years. Half a million of contented cows graze upon luxuriant clover, timothy, or blue-grass pastures all over the State, and are watered at the numerous streams of purest water which wend their way from the ten thousand beautiful springs with which the State is dotted, and are of inestimable value to her agricultural interests. Minnesota is improving so rapidly in this special branch of farming that soon she expects to have a world-wide reputation for being the great bread and butter State of the Union. Already her dairy products are attracting attention, and at great fairs she has been able to bear away some of the prizes so significant of true progress and her dairymen hope ere long to be able to gather in many more of the laurels so long and justly held by the sister States, Iowa, Illinois and Wisconsin. This progress in agriculture, as before stated, is largely due to having introduced the cow as the all-important factor to make diversified farming remunerative. Let me emphasize this point, the cow is fully as important to make general farming a success as is the rudder important and indispensable to the management of a ship at sea. Let this be the order, Farm, Wife, Cow. A start of this kind is sure to win. There is no such thing as luck, in farming or any other business. It's pluck, energy, or as we call it up North, sand and good management that brings success. If Minnesota, Iowa, Illinois, Wisconsin, New York, Ohio, and many other States can revolutionize and bring general prosperity to their every interest by an introduction of the dairy and stock into the system of farming, why may not the same favorable results be derived by inaugurating this interest in Tennessee? Central and Western Tennessee seem to possess all the natural resources necessary to make this section well adapted for incorporating this interest with success into the farm. The Mississippi Valley seems to outline the greatest dairy regions of the continent. This section of Tennessee is one of the most productive portions of this valley, and a striking similarity exists in the general outline and features of this section and the best dairy regions of the North. In other words all must concede that this section of Tennessee is directly in the so-called dairy belt of the Mississippi Valley States. All that is necessary to make

the dairy interests as prominent here as in other dairy sections is to properly initiate this industry as a special branch of farming. To do this such conventions as this are indispensable to assist in educating the agriculturists in the best methods, and to encourage co-operation which is indispensable to rapid improvement in this special interest. Of all things avoid making the dairy interest the only interest, rather introduce it as a department of farming. The proper introduction of the dairy into farming encourages and makes easy many other branches of farming that are likewise profitable. The raising of young cattle, hogs, poultry, etc., is made remunerative by the use of the feed that is produced after the cow has already paid a good profit in the cream she has yielded. In turn all of these animals are indispensable in assisting to furnish fertilizing material for the farm. As a help to those who may not yet fully understand how to manage or introduce the dairy interest as a branch of farming, let me suggest the importance of making a right start, by selecting only the very best cows you can get for use in the dairy ; by this I do not mean thoroughbred or high-price animals, but such cows as will show good results at the pail and in the young stock produced. If a cow will not produce at least 5,000 pounds of milk in a year that will yield not less than 200 pounds of butter, she is not worth keeping in the dairy, and the sooner sold the sooner she ceases to be a bill of expense to her owner. It costs but little more to feed a cow that will produce six, seven or eight thousand pounds of milk in a year than to keep one that will produce half this amount. Having good cows adapted to the climate, do not forget the importance of using only good feed. Remember well that results at the pail or on the block are always determined by what is taken in at the animals mouth. Feed poor, product poor, and in many cases malignant and contagious diseases have been propagated among the inhabitants of cities by carelessness in feeding cows, and annually thousands of children die from the same cause. Feed only such grain or ground feed as would be healthful for the use of the family. Avoid all fermented slops or screenings. Pasture on timothy, blue-grass or clover pasture if possible. Having once secured a good blue-grass or tame pasture, keep it in pasture year after year, and annually top-dress, harrow, roll,

and occasionally reseed it, and you may have a pasture that dry weather will not materially affect, and that will sustain more animals to the acreage than by any other method that can be pursued.

While on this subject, I would not forget the value and importance of sweet corn and field corn fodder. An acre sown or planted to sweet corn may be made to produce more feed than several acres of grass. Especially would I urge the importance of this in localities where the soil is sandy, and long drouths prevail. At such times and in such localities animals should not be allowed to feed on the pasture at all. The dust and sand taken into the lungs will soon destroy them and often convey the impression that the animal has pneumonia. With proper attention in this respect, and with an introduction of the silo, and good sheds for shade, I am inclined to think that dairy farming might be successfully introduced into all parts of the Southern States, and especially into Mississippi and Louisiana. Pardon what may seem a deviation from the subject, but feed is of such importance in the management of the dairy that I thought these few suggestions not out of place. Having decided that good cows are of prior importance to success in dairying, let us consider the best methods of manufacturing and handling the product. First of all let me say that the purity of the dairy product should be held as sacred as the purity of the ballot-box. Good butter and good cheese can only be produced through careful experience, and more, it is a trade of itself and those succeed best in manufacturing these products who have a natural adaptation for the profession. All may attempt to become preachers, lawyers, or mechanics, yet but few make a success of these special professions or avocations, and it is true that but few succeed as manufacturers of butter and cheese. Nearly every housewife imagines that she can make as good butter as ever was used, and yet the conglomerated mass of stuff, called butter, that may be found in produce houses and markets where the bulk of the butter is made on the farm, attests to the fact that they are fearfully mistaken. The loss to the dairymen by manufacturing on the farm, amounts to several millions of dollars annually, which loss might be avoided by employing only professional butter and cheese makers. This

cannot be profitably done in the private dairy, and so we come to the sensible conclusion that co-operative or creamery dairying is the best method by which a uniformly fine butter or cheese product may be produced and at the same time the pro rata expense of manufacture and marketing is lessened.

The value of the production of the creamery or factory over that made in the private dairy can be readily ascertained by consulting the daily market reports, which indicate that creamery butter of a superior grade is worth nearly if not quite double the price of the farm-made butter. This is not always because the creamery product is the best, but because of the uncertainty that surrounds all butter that has not an established brand reputation. Good butter and cheese is a luxury, and all prefer it to vile imitations or adulterations, and will have it if within the reach of their financial conditions, consequently the great problem should be, to lessen the cost of production. No community can afford to use a poor or an adulterated dairy product. We believe with Professor Wiley, who has long been Chief Chemist of the Bureau of Agriculture, at Washington, that "good butter is a mark of higher civilization." He says, "You may find a school-house on every square mile of land, and church spires may be so numerous in every village that they remind you of the masts of Liverpool; but if the butter is streaky and rancid, full of big lumps of uncrushed salt, and little lakes of curdy brine, the community has not yet reached the higher civilization and the nobler culture; wherever you find sweet, pure butter, you will find peace, prosperity and refinement.

Then we have deducted these facts, that diversified farming is the only style of farming that is profitable permanently in any section; that the dairy is an important and essential feature of every well-managed farm; that the creamery, factory or co-operative method of manufacturing butter and cheese is by far the most remunerative; that brand reputation is of the greatest importance to the creamery proprietor, and from the increased revenue he is able to realize is of value to the patron who furnishes the milk or cream; that constant good care and regularity in feeding and managing the dairy is indispensable

to success, and we must all understand well the fact that the great and wise Creator of all things provided pure water, pure air, and surrounded us with all the means for supplying ourselves with only healthful, unadulterated foods, and if we as agriculturists and dairymen fail to do it, and fail in uniting as one great army of faithful workers for the protection of our farm industries, we fail to do our duty to both God and man.

TENNESSEE CREAMERIES.

BY STANLEY H. BELL, OF NASHVILLE, TENN.

Another speaker on the subject of Creameries was Stanley H. Bell, Esq., of Nashville, Tennessee.

Mr. Bell, who is President of the Tennessee Creamery Company, at Nashville, is an able and eloquent speaker and his words made a deep impression on his hearers. Mr. Bell spoke as follows:

This subject, allotted to me by the promoters of the Interstate Agricultural and Industrial Convention here assembled, is an important one, and intelligently treated, should be alike interesting to the delegations from all the States represented in this body. Interesting to the representatives of Southern States because of the admitted necessity for a diversification of their productions and industries, and to those from the Western States because it is desirable that they should be correctly informed as to whether the natural conditions exist in Tennessee for the profitable establishment and development of an industry which has proven so important an auxiliary in the development of the agricultural prosperity of those sections of the Eastern and Western States which, blessed with natural advantages, have diligently and patiently pursued the industry to a successful consumation. It is proper that I should preface what re-

marks I may make upon this subject by the frank avowal that I am not, and never have been, a farmer, and am unfamiliar with the practical details of the farming avocation. I have been engaged in business pursuits from early boyhood, chiefly, however, and during the greater portion of my business life, as a commission merchant, or agent for the sale of cotton produced by the cotton planters of Alabama and Mississippi, who marketed their cotton in the city of Mobile, Ala., where I resided until about eleven years ago, when I removed to the city of Nashville, the capital of this State, and the commercial center of that beautiful and fertile portion of the State known as Middle Tennessee, and comprising the counties east of the Tennessee River, and west of the Cumberland range of mountains.

My business life has, however, brought me in continual contact always with the farming class, and this fact, combined with a natural taste for fine stock and agricultural pursuits, has caused me to take a constantly increasing interest in such matters. This taste more than anything else, led me some year or more ago to take a moneyed interest in a business enterprise known as the Tennessee Creamery Company, operating in Middle Tennessee and with headquarters in Nashville. In Nashville the Company buys milk from the dairymen and sells it to consumers in that city and elsewhere, churning the surplus milk and selling the butter and buttermilk also. In fact, conducting a complete creamery, with the exception that they make no cheese at that point. The company also runs under a lease a creamery at Murfreesboro, Tenn., and under a contract handles the products of a creamery at Lebanon, Tenn. At these two latter creameries, cheese as well as butter is made. The stockholders and directors of the Tennessee Creamery Company are prominent farmers and dairymen in and around Nashville. Of this company I am President.

These introductory remarks will, as intended, convey to your understandings that what I may say upon this subject is from the standpoint of a business man interested in and identified with the creamery industry in the State of Tennessee, and not pecuniarily interested in either stock-raising or farming.

Proceeding upon the presumption that many of the delegates present from the Southern States are entirely unfamiliar with the industry under consideration, it is proper, even at the risk of wearying our Western friends, that there should be at the outset a brief statement of what a creamery is, etc.

WHAT IS A CREAMERY?

A creamery is a factory for making butter, or butter and cheese, on a large scale, under improved methods, where every detail, from the feeding and stabling of the cows to the milking and delivery of the milk to the factory, including the proper care of milk while on the farm and in transit to the factory, is governed by uniform rules and methods prescribed by the management of the factory. Cleanliness and neatness, from the cow's udder to the consumer's mouth, is the one rule which should be inflexibly enforced as an absolutely necessary condition and prerequisite to the manufacture of what is known to the trade as choice or fancy creamery butter.

A properly arranged and conducted creamery or factory possesses the necessary conveniences for caring for milk and cream at the proper temperature, no matter where the mercury stands, steam being used to raise the temperature in the vats in winter, and ice or cold spring water to lower it in the summer. These facilities, which cannot be afforded by the average private dairyman, enable the factories to produce a uniform grade of butter during all the changing seasons. Some creameries or factories take only the cream from the farms, leaving the skim milk with the farmer, to be either fed or wasted, according as he is intelligent and thrifty, or ignorant and slothful. Such creameries are conducted upon what is called the "cream-gathering system." This system, much in vogue in the West, but which nowhere produces as fine a grade of butter as the system which requires the delivery of the entire or whole milk, is not adapted to the South. The intense heat of the Southern climate in the summer season, when there is the greatest flow of milk, causes the cream to decompose before it can be raised from the milk. From such cream, even though of uniform age, choice butter cannot be made.

Other creameries require the delivery of the whole milk, from which, by the use of a centrifugal machine, termed a separator, the cream is extracted from the milk immediately upon its arrival at the factory. In such factories the skim milk is either made into cheese, and the whey formed after the cheese is made fed to fattening hogs, or the skim milk is sold back to the farmers, to be either fed to hogs or calves. This little machine is called the "separator," and which can be run by either horse-power or steam, has rendered factory butter and cheese-making practicable in the Southern States. Under the old methods, running waters of a certain low temperature was necessary to raise the cream thoroughly, and without decay. Our climate requires for this purpose colder springs even than the more northern States, and yet we do not possess springs of as low a temperature as that section.

With the separator system a spring or well cool enough to extract the animal heat from the milk before leaving the farm is all that is necessary. The separator does the rest. If dairying is a desirable or necessary industry, then this invention is indeed a boon to the South. It deserves a more extended notice than the limits of this paper will admit of. Its work is so perfect as to suggest that there is human intelligence concealed somewhere about it. It is the only invention that I ever saw or heard of which absolutely does what is claimed for it—if not more.

The separator is the one which my experience teaches is the best, if not the only system adapted to our climate. Where it is desirable to handle milk a long distance from the creamery, separator stations can be established to which neighborhoods can carry their whole milk to be run through the separator, and the cream alone sent to the factory, the skim milk being carried home by the farmers, or, if more desirable, fed to their respective stock in their respective pens around the separator station. Or, if preferred, a cheese vat could be added and cheese made from the skim milk at the separator station, which then might also be called a cheese factory. These separator stations could be so constructed that they could be readily enlarged to a fully-equipped butter and cheese factory or creamery, whenever the production of milk in that neighborhood warranted it.

One word about choice or fancy creamery butter. Owing to the cleanliness, neatness, and uniformity of method in its manufacture, it can be relied upon to keep sweet longer than the best private dairy make. It will also go further in consumption, because, being made of pure cream, there is more butter to the pound than in private dairy butter, which is usually churned with some milk, and the milk not thoroughly worked out afterwards. Three pounds of choice creamery butter will go as far in consumption as four pounds of average dairy.

WHAT ARE THE BEST NATURAL CONDITIONS FOR THE PROFITABLE ESTABLISHMENT OF CREAMERIES FOR THE PRODUCTION OF BUTTER AND CHEESE?

The answer suggests itself: Fertile soil, rich pastures and cold springs of water on the farms, with a climate in which the industry can be carried on in the winter as well as in the summer; in fact during every day in the year, with an advantageous situation with reference to markets. Does Tennessee possess these requisites? I speak only of Middle Tennessee, to which my observations and limited experience have been restricted and that section of the State I can unquestionably declare is exceptionably blessed in these particulars. I can also testify upon reasonable information that the major portion of East Tennessee and several counties of West Tennessee are also specially favored in these particulars. I quote an article of mine copied from the February number of *Agriculture*, a dairy paper published in New York City, entitled, "Tennessee for Dairying:"

"The climate, soil and grasses of Tennessee are equal to those of any other section. This insures a cheap production of milk. But more essential still, the farms of Middle Tennessee are blessed with natural springs of water of a temperature which enables the farmer to take proper care of his milk at home, and without this care at home, choice butter cannot be made at the creamery.

"Middle Tennessee as a winter dairying section has no equal in the United States. Choice winter-made butter may be sold at high prices in New York or New Orleans, or any other ac-

cessible market in the United States. The climate of Tennessee is such that green food for milk cows may be had every month in the year, with the exception of January and February. Early-sown wheat, rye, or barley furnish admirable fall grazing, and comes out in March sufficiently to give good bite to milk cows. Herd's-grass and blue-grass that have not been mowed or eaten down the previous year are so protected by the old dead tops as to furnish grazing on Southern slopes even in the severest winter months.

"Tennessee has many eminent advantages as a dairy State. It can make butter as cheap or cheaper than any other State, because good grazing lands are cheaper; because it is the most Southern State that grows a great variety of grasses and forage plants; because the climate is mild, and cows have access for a longer period to those succulent grasses, which are so promotive of the heavy flood of milk, and consequently winter dairies can be carried on for a greater length of time—the winter being the season when prices for all dairy products rule higher, are in more active demand, and consequently yield larger profits.

"The past summer has demonstrated that cheese can be made successfully here during the heated term. Tennessee butter is now given the preference over Western butter in New Orleans and all the Southern cities, because the time of transit from the point of production is less, and consequently the butter is fresher. There is a wide outlet for Tennessee butter in that section of our country.

"While the spurious dairy products are seriously affecting the dairy interests throughout the Northern States, and in a degree the State of Tennessee, yet the competition with butterine, oleomargarine, etc., is not so sharp in the States north of us, and this competition should be kept down as far as possible. If the manufacturers of these spurious products will put them on the market correctly labeled, there is no law to prevent their sale. But every effort should be made by co-operative movement, by legislative enactment, by the creation of a healthy public sentiment, to repress the vile fraud of palming upon consumers a product which has nothing in common with butter except in appearance. Our dairy interests are of too much

value, the outlook for them is too promising to have them destroyed or even checked in their growth by a trade that does not differ in morals from a trade in counterfeit money."

In this article I have said that winter dairies can be carried on for a greater length of time, etc. This would imply the belief that there was some portion of the winter when the creameries could not be run for want of milk. Such has not been the experience of the creameries with which I am connected. The creameries of Nashville, Lebanon, Murfreesboro and Bellbuckle, all in Middle Tennessee, and conducted upon the whole milk and separator system, have not stopped for want of milk a single day during the past winter, and at most, if not all of them, more milk is being delivered now than there was in August. The only creamery in Middle Tennessee which has suspended operations at all is one at Clarksville, which was attempted on the cream-gathering plan. I confidently believe that by next winter at this time the quantity of milk delivered at the creameries mentioned will be doubled or trebled. Murfreesboro is now receiving about 3,500 pounds of milk per day, or a little over 400 gallons; Lebanon about 2,500; Bellbuckle as much, and Nashville about 3,000 pounds.

The market for their butter and cheese is practically unlimited when their goods are properly made. Is this being done? is a very pertinent question right here, and I answer, yes; although at first there was some difficulty because the dairy farmers contributing milk thought they knew more about how to feed, milk, and care for their milk than the management of the creameries did. That little difference was, however, soon happily and without friction settled in favor of the creamery managers, and now everything is proceeding smoothly. We have marketed the butter produced by our Middle Tennessee creameries during the past two months through commission houses in New York and New Orleans. In such transactions the butter is sold on its merits. We have oftener than otherwise obtained the quotations for Elgin extras, and never more than one cent per pound less. Not more than a week ago the Tennessee Creamery Company was offered by a firm in New Orleans the same price which they had been

paying in Elgin, Ill., for their weekly supply of butter—that is, they offered to transfer their contract to Middle Tennessee. What do you think was their weekly requirement? Only 2,000 pounds of choice creamery butter per week. Think of it; one firm offering to take more butter than all the creameries in Middle Tennessee are making! Fortunately they also offered to let us have half the contract until such time as our increased production would enable us to take it all. What were the moving causes with them to this course? Something may be ascribed to their sectional pride prompting them to give their patronage to Southern establishments, but they could not have indulged this sentiment at the expense of a poor article of butter. It was because the butter was as good as the Elgin make that they could take it. It may be that they deemed it better for their use and if not better in the original manufacture, preferable because of the short transit from Nashville, which insured the arrival of the butter in a fresher condition.

Who after this will question the existence of a market for all the choice creamery butter which can be made in Tennessee, and does it not speak volumes for our section that with less than a year's experience, Middle Tennessee can make butter which will take rank in the expert markets of New York and New Orleans alongside of the famous production of the Elgin, Ill., section, where they have had eighteen years' experience in perfecting the details of the business? While this could not have been effected except under the management of skilled butter makers trained to the business, yet their ability to accomplish such results was due to the fact that the cows in Middle Tennessee, even in the most rigorous winter, get a bite of green stuff every day, and a sufficiency of exercise in the pastures to keep them in perfect health and content.

The Northern creameries get their winter milk from cows which are stall-fed entirely and never get any grass, and the milking being done in close barns, the butter carries a more or less barn taint, which will not be found to characterize winter-made butter from Tennessee. It requires no enthusiast to predict the result when the details have been perfected in our section as they have been in the Elgin section.

Middle Tennessee as a producer of winter butter, and Nashville as a prospective butter and cheese center, deserve the highest consideration. The region around Nashville is not surpassed in the United States in the advantages it possesses in the production of winter-made creamery butter, and that is the season when prices rule high. A section which can produce milk cheaply all the year, instead of only from April to November, as is the case in most of the Northern creamery sections, possesses advantages which can hardly be properly estimated. These advantages must and will tell eventually. Middle Tennessee alone can and ought to produce ten (10) pounds of winter-made creamery butter where the section around Elgin, Ill., produces one, and it ought very shortly to produce a better winter-made butter. The market for such goods is practically limitless. You can find a market for it at every point of the compass. If we were making 25,000 pounds of butter per day in Middle Tennessee to-day, we would have a better market than with our limited production. We have New Orleans and other cities in the South, Memphis in the West, New York in the North, and Washington and Baltimore in the East. It requires 100,000,000 pounds of butter to supply the New York market annually. The railroads and express companies encourage the business by the offer of lowest rates in all directions. It is the only business with which I was ever connected that did not have a worry with the transportation companies. They want to aid its development. There is a good deal of transportation in the business. These facts settle the question of market. Will the industry be remunerative in Tennessee? That depends upon circumstances. Tennessee already produces a great deal of butter under the old home churning process. It will certainly pay to run that milk through a creamery where there are enough cows to justify one, and there are many neighborhoods where there are enough.

These will do to start on, and if they prosper the industry can be adopted elsewhere. A creamery would treble the value of such milk as compared with the present methods. Farmers' dairy butter is worth in the Nashville markets 8 to 15 cents a pound, and worth no more anywhere else. Concede the average price as 12 cents. The yield of butter under the farmer's

method will not exceed one pound to $3\frac{1}{2}$ gallons of milk. The huckster who buys on his farm wants his profit, and probably for the pound of butter made from $3\frac{1}{2}$ gallons of milk he realizes 9 cents, or $2\frac{1}{2}$ cents a gallon. This takes no account of the labor and worry expended by the good housewife in churning. The creameries in Middle Tennessee are paying an average of $10\frac{1}{2}$ cents a gallon for milk, or more than four times as much as the farmer gets for it turned into his kind of butter. It would certainly pay the farmers to have a creamery in such neighborhoods as those. Would it not?

The Sheboygan (Wis.) *News* says: "Some one asks, who can beat the average price of milk carried to the West factory for the season of 1885? We answer: The Center Creamery by 4c per hundred pounds for the corresponding months—April to October. Not much to brag of, to be sure, but just a little ahead, ours being 70c and theirs 69c."

Here is an old dairy section bragging on getting 70 cents a 100 pounds for milk, and that for only seven months in the year, having to feed the cow the other five months to keep her warm. Creameries in Tennessee can afford to pay $33\frac{1}{2}$ per cent. more than this the year round; and if it pays to carry cows around Sheboygan, Wis., it would seem that it ought to be profitable in this State.

The Hartford *Courant* says: "The business of associated butter making by the cream gathering system is rapidly extending in Connecticut. Several new enterprises of the kind are being organized and others are still being talked up. The Southington Creamery reports the average net earnings per cow for the year 1884 to have been \$64, showing a cost of \$15 per cow for expenses."

I quote the following from the *United States Dairyman*: "Dairy farming adds \$1 per acre to the value of land, while it saves \$1 per acre of the value of land as against grain farming. This is \$2 per acre—good rent. Twenty of the poorest milk cows in the county, that two men can milk in one hour and a half in the morning and one hour and a half in the evening, will pay the wages of two hired hands and furnish groceries for a good sized family by selling cream at ten cents a gauge. The

skim milk will raise twenty hogs that will be worth \$6 each—\$120, and to this may be added \$300 worth of calves—as clear profit over and above the crop raised by the two hired men. Don't calculate on simply the price of cream, but take the results at the end of the year."

Ten cents a gauge is 40 cents a hundred pounds of milk. We are paying two and one-half times this.

Here are some figures from the Wisconsin Dairymen's Association: "Mr. Curtis, of New York, estimated the cost of keeping a cow in that State a year at \$37. Another party in the same State places it at \$37.50. A Wisconsin dairyman placed the bare subsistence ration at \$20, and the same amount to be added for profitable dairy products, making a total of \$40. Professor Henry, of the Wisconsin Agricultural College, puts the cost at \$28.50. D. W. Hoard reported a dairy herd of fourteen grade Jerseys which averaged \$84.49 value of yearly product at a cost of \$35 per head for keeping. The average of the five estimates above given is \$36.50, and this is probably not far from the actual cost. Taking these figures as a basis, and knowing what he realizes each year from his dairy, the farmer can approximate the average profit realized per head from the cows. At the same meeting the question of feeding grain to cows on grass was up. The general opinion was expressed that it did not pay when pastures were fresh, but did when they began to be short."

Tennessee is already famous as a nursery for thoroughbred cattle. I am informed that Tennessee possesses more cows with a butter record than any State in the Union. I believe it requires a production of fourteen pounds of butter per week to entitle a cow to a registered record. One has only to view the herds of thoroughbreds in the State to understand the reason. Our climate and soil and grasses seem to produce model or picturesque cattle.

The breeders of thoroughbreds get an additional profit from the sale of their milk to an adjacent creamery. Now that it is an admitted fact with the addition of a small quantity of oil meal—and cotton seed meal ought to answer as well for this purpose as linseed oil meal—he can restore the fat or cream extracted

by the separator to make butter, to the skim milk, which he can obtain from the creameries at a small cost. With this enriched skim milk he can raise and fatten his calves as well as he could with the original whole milk. These thoroughbred calves so cheaply raised, will find a ready market with the patrons of the creameries, who will desire to grade up their stock.

Thus the creameries will become a benefit to the breeder in creating a home demand for his calves from the dairy farmer, who, by reason of the higher price he can obtain for his milk through the creameries as compared with his present method, is furnished the incentive to purchase and the cash to pay for thoroughbred stock. At our creamery at Nashville we are receiving the milk of at least four thoroughbred herds of cattle—two of them being Jerseys and two others Holsteins.

The creameries in operation in Tennessee have demonstrated the fact that the climate does not interfere with the successful manufacture of cheese even in the hottest months of summer. With our present limited production, we have a better market for our cheese than they get in the North. Grocers do not like to carry a stock of cheese in the summer, owing to its perishable nature and the effect of the heat of the climate, and hence are willing to and do pay a premium to factories near at hand from which they can get supplies according to their demands. The production in Tennessee will have to greatly increase before this advantage will be lost. Again, from some cause our skim milk cheese, made from our winter's milk, seems to be superior to similar grades of goods made from summer's milk in the North, and the skim cheese consumed in the South in the winter has generally been stock made by the Northern creameries in the summer. It would surprise some of the Northern creameries to learn how much more Tennessee creameries, from the causes just mentioned, have been realizing, and are able to realize, from their skim milk than the Northern creameries. Our Western friends familiar with the industry will understand the significance of the statement when I tell them that we have sold our winter skims on their merits, through commission houses in New Orleans and other Southern cities, just at double the quotations of summer skims from Western factories.

The Tennessee farmer has never done much, as a rule, in the way of fertilizing his lands. Carrying cows for their milk would soon teach him the importance of it. There would be such a large deposit of valuable fertilizing material that he would soon take to spreading it on his lands, if for no other reason than to get it out of his way, and the beneficial effects of such action would speedily stimulate his understanding to an appreciation of its value to all of his crops. Tennessee farmers need also a ready money crop. Carrying cows for their milk to be sold to creameries supplies that want. Creameries, as a rule, pay for their milk, after the first month, every two weeks.

In the three creameries at Nashville, Lebanon and Murfreesboro there are not less than one hundred farmers who draw money every two weeks. These creameries are now disbursing an average of \$50 per day each to their respective milk patrons. A few are getting as much as \$300 per month. Next year I confidently expect, from the feeling existing around these creameries, that the aggregate of their disbursements will be doubled, if not trebled. These farmers have a veritable home market for their grain and hay. They feed it to their milk cows instead of carting it to market, and these valuable domestic animals make a double return for the care and food bestowed upon them. They return in fertilizing material an equivalent for their food, and the money for their milk and calves should be counted as net profit.

OLEOMARGARINE AND BUTTERINE.

It is true that the dairy industry of the United States, as a whole, is to-day engaged in a death struggle with a nasty but powerful competitor; nasty in its ingredients and in its methods of deceiving consumers. I allude, of course, to that counterfeit of pure butter known as "oleomargarine" and "butterine"—sometimes called "imitation creamery." Like other counterfeiters, it masquerades under various aliases. The fight will be to the death. One or the other will go to the wall. No compromise will satisfy the needs of the situation. Who for a moment can doubt upon whose banners the victory will finally

perch? But the struggle may be continued for a great while before decisive results are obtained. Meantime, while sympathizing deeply with the dairymen of the North and West in the calamitous effects of the competition on their section, I can but felicitate the dairymen in Tennessee upon the fact that this competition can work but little injury to the present or prospective dairy interest in this State. If this dangerous competitor is not speedily throttled, the pure products of the dairy must be curtailed somewhere. Consumption will not sustain both. The dairy sections, with the fewest natural advantages will be compelled to yield first. Upon the principal of the survival of the fittest, Tennessee's dairy interest will be certain to weather the storm. Our great advantage would be in the fact that we can make fresh creamery butter in the winter as well as we can in the summer. For this fresh winter-made butter we can always expect a demand at remunerative figures to Tennessee creameries. The heat of the climate will prevent the sale of oleomargarine in the Southern markets during the summer, when the contiguity of the Tennessee creameries to those markets will secure for their butter the preference at higher than current prices in the North and West.

Oleomargarine can rage in epidemic form in the Northern markets as well in the summer as in the winter. Their climate admits of this, and then besides in these sections they are already supplied with refrigerating conveniences, which will facilitate the distribution of oleomargarine. Many Northern creameries may, and doubtless will, be forced to close their doors, at least temporarily, while Tennessee can safely build more creameries with the certainty of profitable results. Creameries in Middle Tennessee ought to be as numerous as public gins are in the cotton fields in the South.

An advertisement of a creamery for sale in a Northwestern State recently stated as the chief inducement that there was no other creamery within six miles of it.

While on this subject of oleomargarine, butterine, etc., I may be permitted to express the hope that this Convention will take some action calculated to attract public attention to, and stimu-

late legislative action against this formidable evil. I quote from the opening address of the President of the "National Agricultural and Dairy Association," which met in New York City on the 16th inst. He said, in speaking of the growth of the manufacture of artificial butter:

"Dairymen everywhere found their vocation ruined. The 18,000,000 milk cows in the country had depreciated \$10 a head, and the land on which they were kept, something over 75,000,000 acres, worth nominally over \$50 an acre, had declined 25 per cent. These reductions represented a loss of \$1,000,000,000. This was not brought about through honest and fair competition, but in consequence of the most outrageous and glaring fraud that could be practiced, for the substitute was not sold to the consumer for what it was, but as butter. The people of New York City alone were paying not less than \$10,000,000 for stuff they supposed to be butter, and which brought to the manufacturer one-half profit. Some 700 grocers of the city had refused to deal in the article. Boston, New York, Cleveland, Baltimore, Cincinnati, Louisville and St. Louis, had large butter factories, while Chicago manufactured more bogus butter than all the other cities together. Something must be done to stop this encroachment upon the dairy interests."

Several bills have been introduced and are now pending in the Congress of the United States, and it would seem impossible that such a vile counterfeit could long resist the organized efforts that are now being made against it.

There is no doubt but that it will soon be forced to cease masquerading as butter, and woo the consumer on the basis of its merits alone as an article of food, if no better result ensues from the agitation now going on. I thank the Convention for its courtesy and attention.

CREAMERIES AND DAIRIES.

One of the most interesting features of this Convention was the discussion of the relative merits of the dairy and creamery systems of making butter and cheese. The advantages of the creamery system were very ably set forth by Charles E. Marvin, Esq., of Rochester, Minnesota, one of the largest producers of creamery butter in this country, and by Stanley H. Bell, President of the Tennessee Creamery Company, of Nashville, Tennessee.

The other side of the question was vigorously and ably presented by F. C. Curtis, Esq., of Rocky Run, Wisconsin. Mr. Curtis is one of the best butter makers in the Northwest, and what he has to say upon the dairy question is worthy of respectful attention.

THE CREAMERY AND THE FARMER.

Plants for proper growth require two things—proper mechanical condition of the soil, and plant food. This plant food is largely of an atmospheric character which may be and usually is stored up in the soil to some extent, but it largely exists in the atmosphere, which travels back and forth in dews and rains and evaporation. The decay of all destructible matter subject to decay on the earth is slow combustion; burning is quick combustion; the remaining ashes shows the part of the plant or matter whose home is in the soil; that part whose home is in the atmosphere floats off in the burning up process, or in slow combustion, and returns to the earth in dews and rain, and is absorbed by the earth and growing plants, wherever the soil is in a condition to absorb it. I take the ground that the worn-out soil, as we call it, absorbs very little of this atmospheric plant food, for the reason of its hard compactness. In fact, it seems to repel rather than absorb it. On the other hand, the new soil is loose and friable, and a plant will thrive upon it with much less rain and cultivation than upon a hard worn soil.

If we were to plant a hill of corn on a hard worn soil and make the earth loose around it, and kept it so by hoeing a goodly portion of earth from the corn every night and hoed it back

again each morning, we would find it would thrive with little rain, for the reason that the soil was, in a measure, powerless to retain the moisture and plant food brought to it by the dews and rains, and the hoeing of the earth to and from the plant assisted in retaining these valuable needs of plant growth. From his reasoning it would seem that so little is required of the soil in the growth of the plant that the rich lands of West Tennessee would be inexhaustible, and I think this would be true were it not from the fact that one over-cropping robs the land of its power to absorb the necessary plant food from the atmosphere.

I think I have shown that we can supply the lost power of the soil if we keep stirring the soil as in the case of the hill of corn, but that won't pay; it is too much labor. I have simply taken this method of explanation to make the hearer understand what the difficulty is with this over-crop land, and I shall now endeavor to show how to renovate it or get it into a proper mechanical condition so we can get a fair share of this free atmospheric plant food.

Soils plowed in the fall, as in the North, receive much good in hard freezing and again thawing; but this is not enough; we find our soils require in addition some great mechanical force beyond any power of our own to bring about the desired result, and that power nature kindly furnishes us in grass roots. This great power goes down deep in the soil and draws upward plant food from below and also extracts atmospheric food from the atmosphere above, producing forage for our stock and also the great mechanical power to aid us in tilling the soil. This great power seems to be produced by the lifting force of the plant roots, and when plowed the decay of the plant roots, which is plant food in itself in addition to its loosening characteristics.

Barn-yard manure has great mechanical power as well as it has plant food in its consistency, but the worn lands of the South cannot command a sufficient amount of this valuable fertilizer to renovate its worn fields; you must rely upon the roots of the grasses to aid in this great work of recuperation. With us in the North we find clover best adapted for the purpose, and the use of land plaster greatly aids us in the growth of

clover. In fact, in some worn soils we find it difficult to get a good stand of clover without the aid of plaster. Professor Armsby, of our State Agricultural College, informs us that "Land plaster does not take anything from the air; its action is wholly on the soil. It contains lime and sulphuric acid, both of which are essential to the growth of plants, and in so far as the soil is deficient in these substances it acts directly as plant food. Usually, however, these substances are present in at least fairly sufficient quantity, and then the action of plaster is an indirect one. It has the power of acting on other ingredients of the soil, particularly potash, and dissolving them, thus rendering them available to the plant. In this way, a manuring plaster may be equivalent to manuring with potash, so far as the immediate effect is concerned. Such treatment, if continued, however, must gradually reduce the store of potash and other substances in the soil and thus lead to its impoverishment. With a rich soil this effect would be slow in showing itself, but on a soil having but a limited store of plant food it might show itself in a short time."

Time does not permit me to go further into this part of the subject, and I will proceed at once to pay attention to the creamery and butter part of the subject. My position is this: I endeavor to cultivate my farm 'so as to keep up and add to its fertility; to that end I manage as stated and keep a variety of stock, my surplus stock being largely of grade Jersey cows. I make considerable butter, and for the last fifteen years I have given this subject a study, mainly how to make good butter upon the farm. The great question is, how shall we enlighten the bad-butter makers? I shall endeavor to answer this question just as I would to a Wisconsin audience. I hold that there are two methods—one is by concentrating the milk into large butter factories, or to gather cream for the same. This insures proper facilities and ability for the best product of butter.

Those who advocate co-operation, or a concentration of the milk or the cream into large butter factories, seem to think that the farm dairies cannot command the utensils necessary to make good butter, and could not make good butter even if they had proper conveniences. They argue, with good reason, that

these pupils have failed to take advantage of the instructions so freely offered them for the past ten years, and give it up as a hopeless case. I admit that the situation appears just about as represented, but I do not admit that it was necessarily so. It does seem to me that where it can be so plainly demonstrated that good butter can be made with about half the labor that is now expended on making the bad butter so much complained of, the dullest comprehension would at once accept the improved system of butter making. I claim that I can take a boy sixteen years old, and in one week's time I can learn him to make a tub of butter that will pass for the best creamery butter, and I should be greatly disappointed if it did not stand a better test in the Chicago market than any butter made by the old-fashioned methods. These good old ladies that make butter this way are a perfect stumbling block to all progress—they won't learn themselves or let anybody else learn. I have often had a conversation with them something like this: "Madame, can you make good butter?" "Yes, as good as anybody, if I have butter weather." "Well, Madame, what is butter weather?" "Butter weather is—butter weather." The fact is this lady does not know what the temperature of butter weather is, or the temperature required by her system of butter making. I concede that the rare skill acquired by one of these gifted ladies, with good conveniences that not one farm-house affords in one hundred, with butter weather, which is 62°, she can make good butter, and does usually make good butter, but she does not always do it. One great trouble is she can't command her butter weather; another trouble is, she cannot correctly measure temperature with her feelings. She has not time to fully carry out her instructions that she sets up for others. The result is the butter is not a uniform product, a requirement in all large markets. I claim that a good uniform quality of butter cannot be made this way with the best conveniences, and if it cannot be done with the best conveniences, how much worse it must be with bad ones. I would not have occupied so much of your time to show how not to do it, were it not for the fact that it seems necessary to demolish this great bar to improvement.

The new method that I refer to is called by some the deep sitting—*i. e.*, that part which relates to raising the cream, which

is done by sitting in tin cans $8\frac{1}{2}$ inches in diameter and 20 inches deep in cold water. Well water, which is about 48° , will do, but the nearer the temperature of the water is to 39° , the better. If kept at this temperature the cream will all rise in eleven hours or between milkings, and will be found to be from two to four inches thick, which can be skimmed at once or stand twelve hours longer. The cream is not thick, such as comes from pans, but it is more like sweet milk, and can be best dipped off with a common tin soup ladle. The cream should stand in some place where not too warm until it gets to be somewhat acid—not fairly thickened. When different skimmings are added to each other they should be stirred to insure an even degree of acidity.

A proper degree of acidity produces flavor, too much acidity destroys flavor. Cream should be churned within three days from the time of milking, two days is better. The temperature of the cream should be 62° to 64° in winter and 60° to 62° in summer. The test should be made with a good thermometer; one without a frame for dairy purposes is the better, for the reason that it is more easily cleansed. The churn should be without inside paddles, the agitation of the cream depending upon its falling from side to side. When the butter forms into granules the buttermilk should be drawn off into a clean vessel, and if any butter escapes it can be returned to the churn. If the cream has been churned as I have directed, the butter will be found to be distinctly one thing and the buttermilk distinctly another thing, and will come apart at once. Clear, cold water can be freely used, which rinses out all remaining traces of buttermilk. Some use brine for the last washing, and let it stand upon the butter half an hour or so, which is all very well, but not essentially necessary.

Upon draining the butter it will be found in small particles about the size of peas, and by adding the salt at this stage it can be readily seen that the salt falls evenly through the butter. The churn can be rocked back and forth until it is seen that the salt is worked pretty evenly through the butter, when the cover can be put on the churn and the revolving of it continued until it is worked into a mass, when it can be taken

from the churn, worked a little and packed at once in the tub. My custom is to take the butter out into a tray about three feet long and about fourteen inches wide, one end open. I take about four pounds in one end of the tray, flatten it about as I would to make buscuit, roll it up and flatten a few turns and pack it thoroughly in the tub. Twenty pounds of butter, more or less, in a butter bowl, require the strength of a man to handle. To wash out the buttermilk after being massed in the churn is about as practicable as it would be to wash out the blood of a duck by pouring water on his back, and then to get the salt worked in evenly through the butter in a massed state, it can't be done. Then it stands from twelve to twenty-four hours for the salt to dissolve, and from its uneven mixture with the butter it is streaked. If cold weather, the butter has become hard and set. Not injure the grain? How can it be otherwise? And how can such butter be packed solidly in a tub? Enough has been said in comparison as to making butter by the two different systems. We make butter to sell. Butter made by the old system, even when well made, is a dry butter and will show sticky on the butter tryer. This sticky dryness makes it appear to be over-worked. Butter made by the new system has the salt distributed evenly through the butter, and in a measure remains there, making it what may be termed a moist butter, so that when sampled by the expert, the butter tryer will show a clear brine on the back of the tryer entirely free from stickiness or appearance of having been over-worked. It should also be noticed that this leaving some moisture in the butter tends to more weight, which is not an objection, but desirable on the part of the purchaser. Such being the fact we should not complain.

In closing I claim that the old system of butter making is double the work required by the new system; that its requirements for even a fair make of butter cannot be secured in one farm-house in fifty; that the skill required is beyond the ability of a large part of those usually having charge of the farm dairy, to say nothing about the length of time to acquire that skill and the never-ending drudgery of the over-tasked farmers' wives of our States. I charge, without fear of successful contradiction, that all the bad butter complained of by the

sources previously named, was made by this old drudgery system, or want of system, of making butter; that none of the bad butter was made by the new system unless some soulless cur had adulterated his product with some of the prepared greases of the times. I claim that all the butter made by the system I have advocated for the last eight years is good, except perhaps in a few cases where the parties were changing from the old system to the new. They failed to understand the necessity of securing sufficiently cold water in which to stand the cans of milk to reduce the temperature of the milk to the center of the can to 62° within five hours after milking. This, if not done, introduces decay, or the leaven of putridity, which is likely to increase and injure the quality of the product.

PEAR CULTURE.

BY WM. R. WARD, NEWARK, N. J.

Enough has already been written on pear culture, were it not that many of our writers on this, as on other subjects, are men of theory and not of practice, often misled by enthusiasm, and arriving at conclusions from limited experience.

The amateur who has nursed and watched with growing interest the development of a few pet trees, when nature, aided by skill and perseverance, brings forth the golden fruit as a reward for his industry, imagines that the quality and quantity of the fruit can be accurately anticipated with the comparative size and age of the tree, and that the same results may be obtained by the orchardist.

The professional pear-grower must not base his conclusions upon such foundations.

To the thoughtful beginner, many questions will arise for decision, which can only be answered satisfactorily to the *palate*

and pocket by close observation and perseverance. The following are some of the most important: The kind of soil best adapted to the pear; the preparation and the bestowal of such fertilizers as are needed; manner of planting and pruning; the varieties best adapted for family and market purposes; the adaptation of the quince or pear stocks to the soil and climate; the various insects and diseases which attack the tree and fruit, and the picking, ripening and marketing of the fruit.

The Soil for the pear must be dry, and either deep or capable of being deepened by artificial means. A cold, heavy soil, with clay subsoil near the surface, is entirely unfit, unless materially changed. A soil too rich in vegetable mould induces a beautiful growth of succulent wood, very susceptible to blight, and unfavorable to fruit. Select a free, sandy loam, without being too light and porous, but sufficiently loose to allow the free extension of fibrous roots, with gravelly subsoil, if possible. If this is wanting and other substances form the subsoil, it must be properly drained and loosened as deep as possible. No soil, however rich, that is imperfectly drained, so that it allows water to stand on its surface more than a day after it has fallen, should be chosen. Every prudent pear-grower will, before extensive planting, not only experiment between the pear and quince stock, but also the varieties which are best adapted to his particular locality and soil.

Cultivation.—Too long has it been the custom to neglect the orchard, or the trees growing in our gardens or borders, thinking that to plant is our part of the labor, and nature will provide for our table perfect, well-grown fruit. But if we want perfect fruit, and abundant crops, we must not only give up that portion of ground occupied by the tree, but under and around as far as the roots need nourishment. It is true that we may for a few years after the planting of the trees use the ground to profit by some hoed crop, provided we give back to the soil that which we take from it, but when the tree has attained the age of fruit-bearing, we must relinquish all further drafts upon the soil. The question is often asked: How shall I keep the ground in my orchard? The ground must be kept free from weeds and grass, yet care must be taken not to wound the

branches by close working, or cut the surface roots with the plow-share or spade, bearing in mind that moisture is lost by stirring the soil in midday when dry, but acquired, by so doing, in early morning and toward night.

Mulching I consider indispensable for successful culture. Salt hay is, in this region, the most accessible mulch. After cleaning the ground thoroughly, harrowing and rolling if possible, cover from three to five inches. It will effectually prevent the growth of weeds and grass, preserve a moist condition of the soil, and an even temperature during the midday sun, and prevents severe drouths from excessive evaporation. This is an important point, as the pear exceeds most other trees in rapid respiration. It at times prevents (partially at least) those varieties subject to crack from so doing, as this is produced by sudden changes influencing the sap. It absorbs fertilizing gases which the leaf needs to neutralize and digest the juices brought from the soil, and it also protects the premature fruit which falls before the crop is gathered, preventing its being bruised or soiled by the fall, and, therefore, marketable as second or third-rate fruit, thereby paying all expenses for the mulch.

Pruning should be done in our latitude during the month of March or early in April, after the severe cold and sudden changes are passed, and always before the shoots are a finger long; unless with great caution. Though the wound would heal rapidly later, the removal of a large quantity of leaf would arrest the growth. Nature, giving the leaf not simply to ornament or protect from heat, but as a part of a wonderful system of life. The leaf is, in fact, stomach and lungs to the tree, and neither taste, color or perfume can be given except through the leaf. When large limbs are severed in cold weather the wound dries by exposure, and deadens rather than heals. Summer pruning requires care, yet is very essential to the young tree, as much strength is expended in superfluous wood. Late spring pruning, and also root pruning, are resorted to by the impatient to hasten nature with the fruit, and, unless with great caution, with injurious consequences.

Blight, whatever the cause may be, can only be remedied by cutting below the blackened wood, even though you saw off

the trunk a foot from the ground. The inexperienced should be put upon his guard concerning dwarf trees. Japan, the native home of the quince, is characterized by frequent and genial showers, with damp soil and moist atmosphere, and though partially adapting itself to a variety of climates and soils (being introduced into all the pear-growing countries), yet it is not reasonable to expect as advantageous results as in its own native clime. The effect is truly to dwarf and weaken the constitution of the tree. I do not wish to imply that pears can only be grown successfully on pear-roots; a limited number of varieties grown with such care as an amateur with his few trees would bestow, give a handsome reward for the labor, but the same results cannot be obtained in the orchard. The natural tendency of the pear is to send out its far-reaching and wide-spreading roots for nourishment, and also, to support the heavy foliage and weight of fruit, and to baffle with the severe winds we are liable to encounter near the coasts, and around our great lakes. The quince, abounding in a fibrous mass of rootlets, and feeding from near the surface, exhausts more rapidly the natural resources of the soil, which must be constantly supplied, and from the character of its anchorage it is liable to be destroyed by wind, or blown to one side, giving the tree a life-long deformity. Again, the union of the pear with the quince is often imperfect, the pear growing more rapidly than the quince, forms an excrescence in the place of a union, giving weakness in the part of tree most taxed. It can be proved, by experience, that the varieties grown on the quince can be grown as successfully on the pear; that the standard will produce more fruit the first ten years after planting, and ever after *two fold* or more in excess of the quince; and that the standard will outlive, many years, the dwarf.

Varieties.—The selection of varieties cannot be made by a pear-grower in any one locality for other places. The varieties that succeed West may be comparatively worthless with us. This holds good in the distance of but a few miles, or even upon one's own ground where the soil differs.

We all have our favorite varieties, and are too apt to think that none but these, which we have tried and approved, are

worthy of notice. To convince ourselves what varieties we must grow satisfactorily for market purposes, we must watch the market closely, notice what varieties are called for, and what are bought first, at high prices. Let the number of varieties for market be as few as possible ripening at one time; let those varieties, or better *that variety*, be the most popular in the market that you can grow advantageously; let the season for marketing be as long as possible, commencing with the earliest variety, and continuing until winter. It is a great advantage to be able to supply, daily, the same parties, so that they need not look elsewhere. With these few suggestions I will name those that I grow satisfactorily: Benne Gifford, Sterling, Bartlett, Seckel, Onondaga, Duchesse, Benne Clairgean, Benne d'Anjou and Sheldon—nine varieties—which will give a continuous season of four or five months. Many varieties are unappreciated in the market, which must be added to the list for family use, such as the Doyenne d'Ete, Blood-good, Abbott, Rosti, Benne Diel, Flemish Beauty, Belle Lucrative, Winter Nellis, Glaut Morcean, and others, but all in limited quantities.

The Picking, Ripening and Marketing of the Pear.—Upon the treatment of the fruit at this time depends the profit of pear culture. The pear is included in that general rule regarding seeded fruit, that it should be ripened *off the tree*, and more depends upon the ripening and preparing for sale than upon the actual quality of the fruit. Pick when dry, after it has fully matured, but not softened, when the wormy and imperfect ones are dropping freely, and when, in lifting up the fruit, it will freely part from the limb at the natural separation. Great care should be used in handling, as many varieties have very thin skin and bruise easily, which often produces decay before coloring. Separate wormy fruit, which will ripen before the perfect, to save once handling. Place in a cool, dark, dry room (cellar if possible), where the summer varieties will ripen in from five to ten days.

Winter Fruit.—Place in boxes holding not more than a bushel, and keep in as cool a position as possible; in an out-building, even the north side of house or barn, with cover to protect from rain, and remove to cellar only to avoid frost.

To Retard Summer Varieties From Ripening, we must resort to artificial means to lower the temperature of our fruit room; just in degree as it nears the freezing point, will the fruit be kept from ripening. This process of compelling nature to do her work more slowly, has its advantages and disadvantages. It is expensive; much fruit is often lost; it detracts from the flavor, in some varieties if kept too long, and when taken from the temperature of thirty-eight degrees into the heat of September and October days, it soon melts down, or is discolored. On the other hand we often receive double price, if but only a few days after the natural season, after the bulk of the crop has been marketed, and buyers are compelled to look for their favorite variety. Also by lengthening the time of selling, we may have a month to dispose of that which we would otherwise be obliged to sell in a fortnight.

This process is only resorted to by large growers and fruit-preserving houses.

In packing fruit for market nothing will give greater satisfaction to the buyer, or larger returns to the seller, than strict integrity.

If the bushel box is to be used for marketing your fruit, see that it holds a bushel. If the fruit is fine on the face of the package, see that it is of the same grade throughout. Keep fine fruit by itself, and do not spoil all by working in that which should be marked second or third rate. Let the buyer see from the surface just what the box contains.

If assorted in first, second and third rate fruit, all classes of buyers can be accommodated, and the quality will regulate the price.

Place upon every package your brand, so that the buyer can tell from whom it comes, and upon whom he may rely. Remember these same buyers are to be your customers throughout the season, and from year to year. Again, the buyers are usually shrewd business men, who will not pay for "Topping off," Fancy baskets or colored paper, yet the opposite extreme of neglect of appearance is also to be avoided. Do not mix varieties in the same box, and give to the buyer the correct name.

In packing, whether in barrel, box or basket, use great care in placing, so that all rolling about is avoided, which will bruise and discolor ripened fruit.

To the men whose thoughts and occupations are elsewhere, and who entrust the care of tree and fruit to others, a large interest on capital invested cannot be promised. As in all other spheres in life, one must meet disappointments and difficulties, but persevering labor and energy will bring their reward.

HOW DO PLANTS GROW?

ADDRESS BY E. P. BEEBE, NURSERYMAN, ELIZABETH, N. J.

If there is one subject in agriculture more important than another to the tiller of the soil, *that* subject we have before us: "How Plants and Crops Grow." Would I exaggerate if I were to say that three-fourths of those who really cultivate the soil (plant the seed and reap the crop) cannot explain *how* crops grow from the soil, and indeed had hardly thought of the matter, satisfied that if they plowed, so also should they reap, but in this day of educated labor, "When he who runs may read," with our Farmer Clubs, Agricultural Societies and Colleges, no one, even from the humblest walks of life, but may aspire to a knowledge in science, and may, with propriety, set himself down to cogitate and learn, if he can, from *Nature*, how plants and crops grow. Professor Huxley says: "In strictness, all accurate knowledge is science, and all exact reasoning is scientific reasoning." Plants will grow in water or sand, but crops grow only in good soil. Seed, if placed in soil with sufficient warmth and moisture, will germinate. The first effort is the small roots, through which it is to receive nourishment; from whence the blade, the stalk, the ear. If we examine this small root, at first, it is smooth; but in twenty-four hours hair-like roots de-

velop on the sides, which increase in length and in branches, occupying in a short time all the good soil immediately about the seed ; now the blade reaches through the ground and basks in the sunlight ; is moistened by the dew at night, changes its white stalk for one of green, and in a few days waves in the breeze, a happy, joyous thing of life.

The condition of the soil is the important requirement, in that it furnishes the largest part of the food for plants ; this food it must take in a liquid form through these smallest rootlets, and must therefore be in immediate contact with these roots. If the soil is mellow, the roots will the sooner extend to a larger surface, and increase accordingly in vigor and productiveness ; or, if a little place like a hill for corn only is mellow, and the surrounding earth is hard and will not dissolve by the rain, the roots will not penetrate ; they receive no nourishment, and are not benefited thereby. To find out if the soil is in suitable condition to nourish the plant, place a shovelful in a dish containing water ; the part that will dissolve is its food, that which will not dissolve is yet too coarse to feed the plant, and is of very limited use. It may hold in keeping moisture, undecayed roots or manures, which may in their decomposition eliminate particles of matter, and, in time, be used as food.

The dust from the street is excellent plant food, because it is ground and pulverized, so that placed in contact with plenty of water it forms a medicated fluid, so to speak, on which the plant may grow. Particles of earth, large enough to be distinguished by the eye, could not possibly pass through the minute roots, or sap-vessels, without clogging.

No part of *our* food can form blood, or muscle, or bone, until it is first dissolved to a liquid by the digestive organs ; so no part of earthy matter can enter or form the structure of plants until it is thoroughly dissolved by rains, and enters the sap-vessels through the roots. That a large portion may be dissolved by rain to produce a large amount of food for the growing crop, it is necessary that the earth should be thoroughly pulverized. This, we attempt to do, by plowing and harrowing, but how often is it a mere apology. In this we make a great mistake. Thoroughly pulverize the soil, gentlemen, if you ex-

pect to see *crops grow*. The soil needs *warmth* as well as moisture; vegetable or animal matter placed beneath the surface, commences to decay, heat is generated and gases thrown off, which diluted with moisture, are the most available form of food for plants or crops. Only during the process of decay are plants benefited by animal or vegetable manures, except what the earth has or may hold in store for future use. The earth is a perfect absorbent, collecting and retaining in its keeping food for whatever plants may be placed there at any time to grow. We distinguish the presence of offensive matter by particles of the matter floating in the air, and coming in contact with our olfactory organs. We cannot see these particles, but cover this offensive matter with pulverized earth, and it is retained by it. This very substance, that we cannot see, is in the form suited for vegetable growth; lumps of earth are not so much of an absorbent, neither do they hasten the growing plant. To get the most value to the growing crop from animal or vegetable manures, no part of it should be allowed to decay above ground. As no part of the insoluble earth enters into the structure of the plant, its office is, chiefly, receiving, digesting, retaining and imparting food, to make plants and crops grow.

In conversation recently, with a vegetable gardener, about the productiveness of the soil, he said: "Why, when we first came here, we piled on the manure, but it took us three or four years before we obtained a good crop," showing me that though they put on quantities of manure, it did not at once become available plant food, but had to take time to digest, and so thoroughly diffuse itself through the soil that it was *all good*; and, when the seed germinated the food was there to nourish it at once, and not wait to send out long roots to seek for it. Again, a substance may be in the soil some time, but if not *digested* into food, is not available. A hen will seek and pick up gravel stones to digest her food; so we may, with profit, at times, apply lime to the soil, the alkali acting on vegetable matter or changing the form of gases, digesting food, as well as itself assisting in the structure of the plants; with like benefit we may at times, use phosphates, sulphates, muriates, nitrates and ammonia; also some of the minerals that, when applied, enter into and benefit the growing crop. Then, if the

soil is often plowed or mellowed, exposed to the air, it will absorb large quantities of phosphorous, nitrogen, ammonia, and make plants grow.

The farmer is often benefited in this way, while he thinks he is only killing weeds, or giving opportunity for the rain to penetrate the earth. And then again, when "the rain-drops fall," they bring with them nitrogen, ammonia, etc., from the air, liquid food, *immediately available*. The mellow earth receives much more of this than does the compact hard ground. There it runs off into the ditches and streams without having passed through the earth and imparted life and vigor to the growing crop. Did you ever notice how plants and crops grow, right after a summer shower? and did you think that the rain brought food to them right from the clouds?

Plants grown in water receive or absorb food from the air. A pail of water standing where there is foul air soon absorbs large quantities. On this the plants feed. Orchids will grow and bloom attached to a cork or bark of a tree, getting their food entirely from the air. Plants will grow in sand if there is moisture enough, the sand is so porous that the impurities of the air and water sustain life. Crops that bear seed must have more substantial food.

Root crops, such as beets, carrot and turnips have very few fibrous roots, but feed through every part that extends below the surface of the ground; those that take up the most moisture have large leaves to evaporate the surplus water, which I believe to be chemically pure—the plant in this instance being the chemist. As the flow of the sap is in every case upward, and growth or expansion both upward and outward, it is in many respects similar to that of a tree except that the body and limbs evaporate surplus sap, while for the root crop, the leaves alone being above ground, fulfill that office. The chemist tells us of what the stalk and seed are composed; believing them we try to supply to the soil those particular kinds of food.

Assist Nature! Study Nature's laws, and apply her remedies!

"Nature is man's best teacher; she unfolds
Her treasures to his search, unseals his eye,
Illumines his mind, and purifies his heart;
An influence breathes from all the sights and sounds
Of her existence; she is wisdom's self."

It is not expected that I should give but an outline or describe few of the ways "How Plants and Crops Grow" at this limited time, but hope that these few words may provoke thought on this important subject.

DAIRY AND CHEESE-MAKING.

AN ADDRESS BY EDWARD HAYES, INDEPENDENCE, IOWA.

LADIES AND GENTLEMEN: I am about to address you for a short time on a subject in which I have had considerable experience. I was born and bred upon a dairy farm in the near neighborhood of Cheddar, England (the place from which the far-famed Cheddar cheese derives its name). I have therefore passed forty years of my life in the best dairy district in the world, and consequently feel competent to speak on this most important branch of agriculture—the manufacture of cheese and butter. In fact, I believe it to be the most sure and profitable of all agricultural occupations, and is not so liable to deteriorate from the vicissitudes of the seasons as the growth of cereals and other crops, there generally being sufficient pasture or other substitutes to enable cows to give a supply of milk; and as I intend to become a resident of the South, and with family, I conceive it to be to my interest, as well as my duty and privilege, to advance as far as I can this great industry for the further development of this part of the country.

Since I came to America I spent three years in Iowa, where they have some very large creameries, in one of which I worked a portion of last summer. Where in the height of the season

they make about forty tubs of butter per day, of fifty pounds per tub, and I am ready to admit that in the manufacture of butter they are in advance of anything I have seen in England, it not being a butter-making district where I lived in England. But with regard to cheese-making they have yet much to learn in Iowa. There are a few factories in the locality where I live, the produce of which sells readily in the home market at from 12½ cents to 15 cents per pound; but it is only fit for quick consumption, and lacks the keeping quality of good cheese, which should improve both in quality and flavor by keeping for any reasonable time, and the reason for that, I think, can readily be accounted for. In fact, I have yet to eat any good cheese since I came to this country, but perhaps it is the same as with the beef that they export—the best to England—as I have eaten good American cheese and beef in England—but I guess it wasn't made in the West.

The first essential to making good cheese is to have the milk perfectly sweet and free from taint or smell—which can only be procured by perfect cleanliness and a cool temperature, and for this purpose it is necessary to have a good and plentiful supply of cool spring water adjacent to the factory, so that in warm weather the evening's milk may be immersed during the night, or better still, if practicable, to have cool water flowing around it. When the morning milk comes in it should be mixed and set at a temperature of about eighty degrees, when the rennet and color, *if required*, should be stirred in. A sufficient quantity should be put in to turn it to a curd in about three-quarters of an hour; it should not be longer coming, or it will cream over and cause a waste of the best part of the milk. When it becomes sufficiently hard the top must be turned over gently, and a little soured whey, kept over from the previous day and heated to about ninety degrees, should be thrown over it. It is then ready to be cut up in pieces about one-fourth of an inch in size, when it must be allowed to settle a sufficient time to dip or drain off the whey, for scalding which is a very important process in cheese-making, as it is necessary that every particle of curd should be uniformly scalded, or the cheese will not be solid after made, but will keep rising and become spongy and of bad flavor. If, on the other hand, it is scalded too hot, the

cheese will be poor and tough, and will not get mellow ; so in order to get the desired firmness with the least possible heat, and also to procure uniformity, it is necessary to keep the mass gently stirred until it is firm enough, keeping it at about ninety degrees of heat, when it must again be allowed to settle and the whey drawn off, when it should be piled up and covered with warm cloths to produce fermentation, after which it is fit for grinding, salting and taking up in the vat or moulds and put in the press, where it must be pressed for about thirty-six hours, being turned twice during that time. And here I would remark that the presses I have seen used in this country are very inadequate for that purpose, as they only press as long as the operator continues to turn the screw, after which, as the whey drains off and the curd subsides, the pressure is removed until it is again screwed down, whereas the pressure should follow the cheese as it subsides in the vat. After the cheese is pressed it must be bandaged and taken to a warm room to ripen. After remaining here about a month it should be removed to a cooler place to harden, when, in a few days, it will be fit for use.

I have now, gentlemen, given you a theory of cheese-making, but no definite rule can be laid down as to the heat or length of time in scalding, etc., as the conditions must necessarily vary somewhat with regard to atmosphere, sweetness of milk, etc. So that much must be left to the skill and judgment of the maker.

I would now repeat, in conclusion, that I do not think there is any more profitable branch of agriculture than the dairy, and no part of the country where it may be made more remunerative than in the South. For if the dairy pays in the North, where the cows have to be fed for about seven months in the year, I can conceive of no reason why it should not be much more profitable here where they require so little care and attention. Cotton-seed are also largely used by dairymen in England, where it is pressed into cakes after the oil is extracted, and is usually sold at from \$30 to \$40 per ton. It is an excellent feed for milk cows, increasing largely both the quantity and quality of the milk.

That a cheese factory is more profitable than a creamery may be readily seen from the fact that the same quantity of milk required to produce one pound of butter will produce $2\frac{1}{2}$ pounds of cheese, so that, putting the former at 20 cents per pound and the latter at 12 cents, would give an increase of 50 per cent. in favor of cheese. Still, I would advocate a cheese factory and creamery combined as being the most profitable, as the milk that comes to the factory at night may be skimmed in the morning and the morning's milk mixed with it, which will produce what is generally called in this country full cream cheese, and if the conditions are favorable for cooling the milk during the night, one-third of the full quantity of butter may be produced. It may be somewhat premature in this part of the country to talk dairying, as you have first to cultivate the grasses and obtain a sufficient number of cows. Still, perhaps there are other parts where these two requisites are already at hand, and if there is any gentleman present who is thinking of going into the dairy business I shall be happy to give him any information I possess.

WHY DO EDUCATED YOUNG MEN SHUN THE FARM?

BY PROF. JOHN W. GLENN, OF KNOXVILLE, TENN.

One of the most thoughtful and learned addresses of the occasion was delivered by Prof. John W. Glenn, of Knoxville, Tenn.

Professor Glenn's address is of special value to parents on the farm, and to their careful perusal, as well as to the younger people, we commend it. Here it is in full:

Some time since a gentleman of the old school said to me, "Your public schools and your free colleges have about ruined the negro." I have heard this sentiment repeated more than once during the past year.

Do not such remarks answer, in part, the questions which my subject raises? Is not the idea prevalent even to this day that muscle and not brain is what we need on a farm?

Do not the farmers generally regard my proposition to use machinery or any devices of the brain, in agriculture, as the prompting of physical indolence or a lazy man's plan to avoid exertion? Would the boy of to-day, who, by brain work, utilizes his dog in working the churn while he plays, be regarded with favor for his ingenuity, or would he be punished for his indolence? Is genius or educated talent reckoned to be in its proper place on the farm?

Does public sentiment generally encourage or ridicule the idea of a learned gentleman devoting his time and talent to active agriculture? Again, are our systems of education generally encouraging to industrial pursuits? Along what lines are youthful intellects urged with greatest vigor? Is the tendency to make thinkers, or dreamers, or actors, or all together? Fellow-citizens, let us consult soberly and seriously on these questions to-night. Something is wrong in our system of training, or in public sentiment, or in the precedents of the past. Why is it that all the brightest and best educated boys leave the farm and seek other avenues by which to make the journey of life?

Does it come from our former system of slavery? and does the notion still prevail that none but a slave will devote his life to manual labor?

The shadow of the old past may be still upon us; but things have changed, and the forces of nature have been harnessed to the farmer's plow, and the boy must begin to see that he who drives the steam plow across the prairie is greater than the son of Apollo who came so near wrecking the heavens; that there are brighter rewards offered to genius along the furrows of the fields and on the steel rails which link nation to nation, than along the sequestered vales of Tempe or on the lofty heights of Parnassus.

Something is blinding our eyes to these grand, promising facts, and our boys go rushing in crowds to poverty through

the professions, following their fathers with the multitudes of the past; while the rich, inviting fields of agriculture lie open, and the large incomes with broad reputations which may be won in shops are utterly neglected.

If the defect is in our educational system it ought to be remedied, and I, for one, will favor any plan which promises better practical results. Is it true, as frequently charged, that a college course disqualifies a boy for farm work? or that a farmer's boy, after going to college, imagines himself too good for the farm?

This may be true in some instances; for I admit that in literary colleges the ambition to seek distinction by industrial pursuits is not so much stimulated as it should be. The young men hear and talk more of the Cæsars and Ciceros than they do of the Cincinnatuses, and they read more of the *Æneads* and *Metamorphoses* than of the *Georgics* and *Bucolics*.

Our youth are not greatly impressed at school with the dignity of labor, and they do not hear enough of the George Stephensons, the Whitings, and most of them have no idea who invented or utilized the reapers and separators, the printing press and sewing machine, and the thousand other results of brain in the fields of industry to relieve the long-taxed muscles of poor humanity, while the names of warriors, the makers of woes, are on every lisping tongue.

These things ought not to be; yet I do not find the sole or main cause at the doors of the schools or the colleges, and I have sought just at that point with much solicitude. On several occasions I have polled my classes at the State University for the purpose of deciding this question.

One class contained seventy-six members; sixty-five came from the farms, and only four of that number had any idea of engaging in agriculture, and two of these were uncertain. Another class of about forty members presented nearly the same proportions—not quite so bad. In a class of eleven, all from the farms but two, not a man expected to be an agriculturist.

After completing a short course in agriculture, and hearing the lectures, some five or six more of these young men expressed

a purpose to choose farming as their business, and several desired to be engineers or machinists; but I do not think all of them kept their pledges.

These facts indicate, very decidedly, that influences had turned these young men's thoughts from the farm long before they came to college; but the saddest part of what I learned was not the fact that these young men were not inclined to be farmers, but I noticed in them a strong aversion to that life, and that it had been growing in them for years. Many of them were determined to abandon the farm at any cost.

Now, fellow-citizens, how can we account for such a state of affairs? Children are apt to respect what their parents respect, and if the parent magnifies his office or profession, his children are apt to do the same. Here is probably the source of the trouble, the main-spring of all the bitter water. Do our farmers honor and magnify their calling? Do they regard it as worthy of intelligent consideration?

Is it such that the men of the broadest talent and greatest learning may find there scope for all their powers? Or do they consider that man best qualified to excel in it who has received the greatest amount of muscle from mother nature? When they hire men to work on their farms, do they wish to engage muscle or brain? Do they grade laborers by muscle or by brain? A short time since I issued a circular letter asking the farmers of Tennessee to give employment to some young men who had been studying agriculture at the State University and who had had considerable experience on the farm.

I have had several replies to that open letter and some, I am glad to say, showed a liberal spirit and a desire to encourage the young men; but most of them seemed to think that \$10 a month, with board in the family, a liberal offer to young men who had spent much time and money in acquiring education and skill. I believe the most ignorant negro laborer, if he be strong and active, can now command his rations and probably a little more than \$10 per month.

SHALL THESE CONDITIONS REMAIN?

Is this magnifying the business of agriculture, not to offer a skilled farmer no greater wages than those of a common laborer? Again, where a farmer has several sons, and he wishes one of them to follow him in the path which he has trod, does he select the brightest, the most gifted of his boys to be the farmer? No, no; patient, dull, plodding Tom is the boy for the old home; Jamie must be the preacher, quick-witted George must be the merchant, and the brilliant Eustace is designed for the law.

It is thus, fellow-citizens, we depreciate and discredit our own profession in our own families.

Even where our boys are trained in a knowledge of agriculture, they are taught it is a reserve calling on which they can fall back if they fail in all others. Our daughters even manifest a decided preference for the young doctor rather than farmer Jones, though the latter be far the better man of the two.

In addition to all these there are certain ideas and customs prevalent in rural districts especially, which rather discourage than encourage the esthetics and amenities of life. Young people like beautiful things; they appreciate ornamentation; they desire to have flowers and decorations about the farmhouse; but they are told there is no time for such things and no crowds to admire them, if presented, as there would be in the city.

It is constantly impressed upon their minds that life on the farm means work, work, work, hard work, and the farm is no place for fine clothes and dainty manners. Is it any wonder that a boy with delicate tastes should long to escape from such a place? Our children have heard that there are homes where there are books and where leisure can be had to read them. Is it strange that an ambitious boy should grow tired of the farm, where he has only the Bible and dictionary, and perhaps the county paper, and hardly an hour in which to read the latter?

Not only is the love of the beautiful constantly discouraged, but the courtesies which make up so much of happiness at

home are disregarded, or if considered at all, they are reckoned among the marks of weakness and effeminacy. Politeness in a farmer, according to common estimate, is no characteristic of fine manhood, but a foppish artificiality.

The boy who would thank his brother for the biscuit at table, or who bids his sister "Good night" is ridiculed for "putting on airs" or trying to imitate the "hifalutin." The young farmer may use all the politeness and courtesy he can command in addressing some other boy's sister; but if he approaches his own sister with any "blarney" he is very apt to be laughed at for his pains and teased within an inch of his life for a silly popinjay. Many a kind-hearted boy with a soul full of love would like to kiss his mother or show her some mark of his regard, but he dare not, and he lives day after day crushed back upon himself until he grows weary and finally sick of an existence so heartless. Ah, friends, this paralysis or suppression of all that is noble and good in our natures is almost as fatal on the farm as is the hollow insincerity which characterizes the circles of fashion in the life of the cities.

Young people are naturally inclined to be polite and most of their coarseness is acquired.

If a young neighbor, or even a stranger called at the farm house, he is treated with marked respect and courtesy; he is carefully lighted to his room every want is solicitously supplied and he is bidden good night with the heartiest wishes for his perfect rest; but to brother Tom it is said, "You had better make haste and wash your feet and go along to bed, sir," and this is the only good night that Tom receives. In the morning Tom is hustled out of his bed early and roughly to feed the horses and as he rubs his eyes open the only salutation or benediction he receives is, "Hurry up and hasten back from the lot to carry water to the guest's room and give him attention until breakfast is ready." Who of the children think of being polite to Tom? "What is the use of wasting politeness on home folks?" Is it any wonder that Tom sometimes thinks that he is far less appreciated at home than even a stranger? When his brothers and sisters have joined with the neighbors and have teased and worried him to the point of desperation, is it strange

that ugly thoughts should creep into his mind and that he should wish to leave the home of his childhood and seek sympathy among strangers? Has he not a greater claim to politeness and courtesy from his own family than strangers or neighbors have? I am sure that more of our young people would remain near the old fireside if the courtesies of life were more generally practiced in our farmer's home.

Again, our boys and girls want recognition; we must praise and encourage them. Do we meet this demand kindly, or do we ridicule their early efforts? Even men will lose their interest in the labors of life if their efforts are not appreciated. Then why should we scold if our children seek in the towns or from their neighbors signs of recognition or expressions of approbation which we should have given them at home?

Somebody has wisely said, give your boy the best acre of land you have, and all the fertilizers and appliances needed to feed and cultivate his crop, then encourage him to work by approval if he succeeds and sympathy if he fails, and nine cases out of ten he will plant himself on the farm and give to it all the noblest energies and best results of his life. Let him have books and papers, let him have time to associate with his friends, let him see much of the brighter side of farm life, and, my word for it, he will have a heart to follow his father, and he will find a tongue to defend his calling and to demand a place for it among the highest. And why should he not? Are there not problems presented by this calling which challenge the noblest efforts of the grandest intellects among men? Is there not immortality for every one who makes a new application of machinery for the farm? Do not the present methods demand the highest intellects to perfect them and extend their application? Supposing a young man to desire political honors, where can he find a way so direct, so broad and so little crowded as the one which leads through the farm? The young farmer need only qualify himself for the position and the people of the South will give him any office in his county or State. Does he seek wealth? The days of the agricultural Astors, Stuarts and Vanderbilts are just approaching. Look at the vast shadows which are projected on the coming future by the great cattle

kings and grain millionaires of the West. Magnify our calling. Have we not facts from the past, reason in the present and bound promise in the future, from all of which pæans may be formed to delight our children? Let genius be invited to the farm, let the best of trained talent be employed there, and ere another generation has passed the farmer will take his place by the highest in social life; the son will receive with pride the mantle of his father and the daughter will transmit the graces and the skill of the mother until our old country seats will become patriarchal mansions, and the farmers' homes shall be centers of culture and beauty,

"Where taste and luxury may abound, and the fairest garlands grow."

THE AGRICULTURAL RESOURCES OF KENTUCKY.

BY I. B. NALL, LOUISVILLE.

MR. PRESIDENT: The subject which brings me before you to-day was not of my own choosing. But should it be wanting in interest, I am very sure the fault will be mine, for it is fraught with great opportunity; and in the hands of one accustomed to speaking, could be turned to good account.

Within the noble sisterhood of States which form the Federal Union is a lesser sisterhood, having for its concentric the point where La Belle Ohio unites with the turbid eddies of the great Father of Waters. Kentucky, like a great index finger, from the crest of the Cumberland Mountains points to this center and touches the very waters of the great stream; Tennessee, stretching over hundreds of miles of mountains and rivers and plains, pushes a corner close up to this great meeting ground of States; the two mighty rivers scarce unite their waters before they wash the shores of Arkansas; Missouri, from the other side, extends her hand in token of friendship;

Illinois, Empire State of the West, joins these mighty streams together at her southern extremity and sends them gulfward; Indiana, Mississippi, Alabama, Iowa, Louisiana and Kansas join the combination. Thus have we here no less than ten great States, like so many spokes of a wheel revolving around a pivot, with their world of agricultural and mineral products giving life to a commerce unequaled, perhaps, by any other territory of like dimensions.

We are met in convention in this city of Jackson to consider the resources of all, and discuss measures for their better development. The variety of our productions, and the necessity for their interchange, binds them all together with commercial links, even did not these great water courses unite us by natural ties. It is assigned me to present before this Convention the agricultural resources of Kentucky. I would shrink from the task of condensing into the compass of an address, suitable for this occasion, a subject that would fill volumes, did I not know that while I lightly skim the surface, you will not believe me oblivious to the unfathomable depths below. For the purposes of this address the State of Kentucky may be considered in her tripartite physical nature. All the eastern portion, embracing some thirty counties, is mountainous, and asserts but little claim for its agricultural productions or for resources in that line.

The scant population by cultivation of the bottoms along the streams, and what table-lands they find, manage to grow enough to sustain themselves, but little, beyond a few rough cattle, for export. These people, as a rule, have not had educational advantages, and it may be, when they learn more of the science of agriculture, of grasses and terraces, they may improve the mountain sides (many of which are quite fertile), and extend their fields to the very crest, like the hardy mountaineers of Switzerland have done. Though this section is so poor in products of the soil it is rich in coal, iron and timber, with enterprises on foot which are expected to awaken it into a new existence, the morning of which seems to be just about to dawn.

Descending from this mountain country, what is it on the very foothills that begins to throw over the landscape that beau-

tiful carpet of green, with its purplish tint? Passing on by forest and farm, by hamlet and village, why this beauty of landscape and look of sweet contentment which pervades all nature and extends to man and beast? Why these crop-burdened fields and living pastures? Why these lordly cattle and majestic horses? Why so much manhood and womanly grace? We have entered the famous "Blue-grass region," where nature has been most lavish with her bounties, and where every step is muffled by the soft, green mat under foot. Poet, artist, historian, orator and novelist, have pictured this favored land in charming verse, brightest color, stirring event and delightful romance. It is proper for me here to look on the more practical side. What products that the world needs does blue-grassdom contribute to the annual stocks? Let us first consider the importance of the plant which gives name to the twenty or more counties embraced in this section. Whether the blue-grass existed here when Boone first explored its depths, as is claimed by some, or was introduced by immigrants, as others assert, we care not. It is certain that it found congeniality in the soil and spread over it as soon as the axe of the settler let in the sunlight from heaven. This grass asserts its right to the surface as soon as the heavy timber is removed, and thousands of acres of the finest pastures have never had a seed sown upon them by man. But of what value is this as an agricultural resource?

It is considered that for general grazing purposes good blue-grass lands are worth \$4 to \$6 per acre per year—this year after year, without the requirement of any labor except the keeping up of fencing, and subject only to an occasional drawback in the way of drought. This, then, would make an investment in blue-grass land at \$50 to \$60 better than an investment in 4 per cent. Government bonds. It yields a rental of that amount, but where the owner resides on it, and couples with the pasturage the cultivation of a portion, it may be made to yield a larger income.

Indian corn has been the companion of blue-grass in the way of making these lands profitable. Fed to good cattle in winter and spring, they are ready for grazing to best advantage in summer and fall. There is no practical way to ripen a bullock



FANCY'S HARRY (9777).

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for the shipping market so early and so thoroughly as by the combination of corn and blue-grass. To enter into the details of growth and gain would encroach too much upon my allotted time.

Blue-grass lands are also profitable to farmers who raise blooded cattle, or young grades, and even for fattening the common stock which is driven from the outside districts. This section is the home, too, of the finest horses—the thoroughbred, the trotter and the saddler. The history of the turf tells us what prowess the Kentucky horse possesses. They are important to the prosperity of our State, and represent in each animal sold so much grain and grass.

The blue-grass lands are based on the limestone and originally formed by its disintegration. It is continually fertilized and restored by drawing upon the rich stores in the subsoil. Exhausted by long and careless cultivation, they are restored to fertility after lying in grass a few years. With proper care blue-grass pastures may be held until winter, when stock may be kept thrifty on it without other feed.

But I shall only take further time to review some of the cereal and other products in respect to the capacity of this soil to produce them. In some blue-grass counties it is no uncommon thing to see fields of fifty to one hundred acres, which yield an average of sixty honest bushels of corn per acre. While it is true that all will not do this, there are many which do even better.

Take a tier of counties and we have an average per acre of nearly forty bushels, inclusive of the crops of the shiftless tenant and the luckless negro. Wheat is also a staple, and the lands yield remunerative crops where the cultivation is intelligent. Without any fertilization fields occasionally produce thirty-five and forty bushels, frequently twenty-five to thirty, and a crop of over twenty bushels per acre is very common. A block of blue-grass counties will average, in good seasons, nearly twenty bushels per acre. Barley yields, here, thirty to fifty bushels per acre, and is a staple crop. Hemp is also one of the crops depended on in this section. The best lands only

are adapted to its growth, and on these it is generally quite profitable. The yield is from 800 to 1,600 pounds per acre, and it sells at about five cents per pound. A crop of 1,000 pounds can be grown and marketed at an expense of about \$25, which leaves a profit of \$25 per acre. As it is not an exhaustive crop it is a popular one in the best blue-grass counties. Many seasons the price will rise to \$8 and \$10 per hundred, when those who have been fortunate enough to hold several years' crops, get a very handsome profit. This land produces remunerative crops of oats, and the meadow grasses, though, because of the large numbers of live stock fed, neither are raised for export to any great extent.

It was not until the advent of White Burley that tobacco became a recognized crop in the blue-grass counties; but now the richest sections are devoted to it, and so profitable has it proven, that the number of acres is only limited by the skilled labor that can be procured to engage in its culture. The owners of these fine lands were at first ignorant of the manner of cultivation required, and leased them to tenants from the hill country, who had had some experience. Many of these latter, if industrious and frugal, were soon able to buy the land with their share of the profits. The tenant system is still adhered to by some, but others prefer to rent their lands and get \$10 to \$25 per acre. Well authenticated cases are of record where crops of over 2,000 pounds per acre were realized and sold at an average price of nearly \$20 per hundred. As the cost of cultivating and marketing was not over \$30 to \$35 per acre, it will be seen that a profit of over \$300 per acre was left. These were exceptional cases, and should not be taken otherwise. But a crop of 1,200 pounds may be expected on any first-class blue-grass land, and an average of \$12 per hundred has been a common rate. This will leave a profit of over \$100 per acre, often on land which will sell for less than that amount. This has only been accomplished with the best of labor and in good seasons, but it shows the capacity of the soil. Taking in the failures, due to drought, to bad management in cultivating and bad handling, the average crop may be set down at over a thousand pounds, and the average price at perhaps \$10 per hundred. Even at this, the acreage would be much greater could

the labor be procured. As it is we have counties credited with well-nigh 4,000,000 pounds, where but a few years ago the plant was unknown.

But I have dwelt longer on the resources of this section of our State than I should. The magnificent stables of horses, herds of Shorthorn, Holstein and Jersey cattle, and flocks of fine sheep and pens of swine, are a direct product of the grass and grain of the blue-grass section.

Next in order comes the Third Division, embracing all that portion of the State west of a line drawn from Louisville south to Tennessee. In it is found as great variety of soil as there is extent of area; as diverse resources as there is range of climate. Along the Ohio River are rich, alluvial bottoms, producing heavy yields of the staple cereal crops—grasses and tobacco. The tier of counties along the Tennessee line have a soil composed of a rich, red clay loam, based on limestone, and very fertile. Both these sections are claimed to be as productive as the blue-grass counties, but their lands have been put to the more exhaustive system of grain and tobacco growing, without employing the restorative which grass gives. Hence, they are not so well preserved. Between these sections comes a range of country somewhat more hilly and not so productive, yet on which a large population exists and adds wealth from the resources of the soil. Their chief money crop is tobacco, but they also raise grain and grass and ship out cattle, sheep, hogs and mules. The Third Grand Division of Kentucky embraces the largest tobacco-growing district in the world. Within it lies the whole of the Green River and a large portion of the Clarksville district, besides what is known as the "Purchase" country. The southern tier of counties is also the best wheat land in the State, fields often harvesting as much as thirty-five bushels per acre, and counties sometimes averaging well up to twenty bushels. As the lands are not so high as in the blue-grass section, and labor equally as cheap, the net profit in wheat is greater than there. The tobacco grown in nearly the whole of the western and southern portions of the State is of the dark variety, which does not bring as high price as Burley, the nearest approach to it being the "fatty," heavy

product of the Clarksville district. The yield per acre of this, as also of the counties along the lower Ohio, is very heavy, in good seasons ranging from 1,200 to 1,600 pounds per acre. The best lands in this division bring \$25 to \$60 per acre, and the lower grades \$5 to \$25, according to quality. Some unimproved land not suitable for cultivation, because rough, sterile or swampy, will not bring so much.

It may be proper to state here that the forest part of this division is underlaid with rich veins of coal and other minerals, the development of which is now furnishing good markets for all the agricultural lands adjacent. The farmers of the whole of Western Kentucky have awakened to the necessity of improving their live stock, and they are building up herds of cattle of the best blood and pedigrees. They are also introducing trotting and draft stallions and blooded swine and sheep. This encourages them to grow more grass, and thus we see that country on the road to future greatness and profit.

Kentucky, with nearly a third of her area naturally unsuited to agriculture, proudly points to her productions of a single year: Corn, 47,681,686 bushels; wheat, 10,574,357 bushels; tobacco, 226,147,027 pounds, being more than double the crops of any other two States, and over a third of the crop in the United States; hemp, 2,567,594, within a few tons of being the whole crop of the Union; hay, 284,323 tons; barley, nearly 200,000 bushels; oats, 4,500,000 bushels. I will not undertake to enumerate the numbers of other field crops, nor take into account the garden and orchard products, which are growing in importance under the teachings of our State Horticultural Society.

The lands of Kentucky, outside of the towns and cities, are assessed at more than \$200,000,000; horses, nearly \$20,000,000; mules, \$7,000,000; sheep, \$1,437,000; swine, over \$2,000,000; cattle \$7,500,000. In these items alone we have a valuation of almost \$240,000,000, and many items which would swell the grand total are not assessed. Consider also that the assessment is limited by law to about two-thirds of the real cash value, and I may safely assert that the plant of Kentucky's agriculture is not worth less than \$500,000,000.

With all the wealth of her resources, all the bulk of her products, our State feels honored at being represented in a convention which has her sympathy and best wishes. She joins hands with sister States in this great effort at further and better development, willing to do all that may come within the scope of her humble capacity.

Since coming here I have heard more of Northern men removing to the South than I ever dreamed of. To all who contemplate such a change, Kentucky extends a hearty welcome and Godspeed. We do not wish to hinder their progress, for when they go South it helps us, our commerce and our agriculture. But there may be some who are only half in the notion. To them Kentucky offers a half-way ground. Come South like you take a foot-bath in cold water, one foot at a time. Try a probationary period with us. We also have cheap lands awaiting development.

DUDE FARMING.

AN INTERESTING EXPERIENCE RELATED IN AN ENTERTAINING MANNER ON THE SUBJECT.

BY COL. W. H. DUDLEY, OF CANTON, MISS.

The following paper, read at the farmers' meeting at Jackson a few weeks ago by Col. W. H. Dudley, of Canton, Miss., was a source of considerable pleasure to the many delegates who heard it, and it is therefore published in full, having been specially prepared by request:

LADIES AND GENTLEMEN: I had intended to prepare a solid address for this occasion, and load it down with arguments so heavy that you would have to use a crowbar to turn them over in your minds. But when I received a programme and saw the

names of the distinguished gentlemen who were to speak, and that my own name was put down for the last, to be a short address at that, I concluded that all that would be expected of me was a short-meter doxology. Being up to-night before my time, I am particularly sorry now that I did not write an essay, since the announcement made this morning that all essays would be published in pamphlet form. Just my luck. Grief consumes me when I realize what a splendid opportunity is thus lost of handing my name down to posterity in pamphlet form.

But I will make you happy at the start by telling you that I do not intend to talk about the cow. This entire day has been taken up in discussing the cow and her products, until now the very atmosphere in this hall is so cowy that a calf would bleat if it got its nose inside the door. I have been sad all day at the facts that have been developed. It has been shown that wheat could not be raised except at a loss, and henceforth wheat must not be planted; that cotton costs more to raise it than it is worth, so there must be no more cotton planted; that the only profitable thing to raise is butter, therefore all the farmers, North and South, must go into the butter business. Heavens! to think that in the future we are to have no bread to eat and no clothing to wear! I love butter, but if it is to be the future solitary food, it is going to be a lonesome diet for me. But there are other things which can be profitably raised and which, when seasoned with butter, would make a nabob "bob up serenely." They belong to that department of farming about which I wish to speak. If I can get your kind attention for a little while I will tell you what I know about dude farming; and to make the narrative a simple one I will give my personal experience as a dude farmer:

About four years ago I was doing well as a cotton planter. I was raising cotton that cost me ten cents a pound, and was selling it for nine cents. I was getting rich so fast that I concluded I would retire and make way for those who were more needy. About this time I read of a man down at Crystal Springs, Miss., who had sold \$1,000 worth, gross, from an acre planted in tomatoes. My ambition was fired. What one man

could do another could. Why not plant 200 acres in tomatoes, make \$200,000 and retire? I was not greedy. I did not want that much money. I thought \$5,000 would be about enough for one year's work. So I settled on five acres as the amount of ground I would plant in tomatoes. I knew I should be near the depot, so I rented my land and moved into Canton, Miss., on the Illinois Central Railroad. As it was a new business, of course it became the town talk. Everybody discovered suddenly that it was a big thing, and promised fortunes to those who went into it. There was soon a tomato craze in the town. Before I planted a seed I found out that everybody was going to plant tomatoes. Some wild man proposed to organize a society. Everybody jumped at the idea. The society was formed with a great burst of enthusiasm. There was high old scuffling and log-rolling for positions. By much maneuvering I sailed in as secretary and raised the dust with an extempore speech of thanks for the unexpected honor conferred upon me. I had worked for it like a ward bumner. Our meetings were frequent and very interesting. Every man told what he knew and a great deal more. One man told about a vine in a rich spot in his garden which grew up over his kitchen, on up over his two-story residence to the top of an oak tree, but he did not get any tomatoes. It was voted by the society that rich land would not do for tomatoes. Another man told about a little vine on a poor red spot in his garden from which he had gathered a peck of nice red ones. He did not tell about having buried a dead cow on that spot a year before. It was voted by the society that poor red ground, the redder the better, to give a fine color, was the kind of soil for tomatoes.

Of course there were many skeptical cusses in our town who snickered at our enterprise and laughed at our society. One old negro politician, in a speech, went so far as to use this language: "What's all dis I hear 'bout raisin' vegetables to sell? Now dat will do for dese ha'r-pin-legged dudes 'bout town to be carryin' on dis dude farmin', raisin' Tom Thum peas and permattuses, but it won't do for de genewine farmer." It was too good a thing for the boys to miss, so they dubbed us dude farmers and it stuck. But I was not intimidated by jeers or ridicule. I pushed along with my work, built extensive hot-

houses, covered my land with cold-frames until it looked like a Bulgarian army was camped out upon it. I thought I had better study up a little on gardening, so I got a quantity of books. I had not read one more than half through before I learned that I would have to know a great many things. In fact, I would have to become a scientist. I found out I would have to study botany and learn the functions of the stamens and pistils—I supposed to keep the pistils from going off and hurting something; that I would have to study entomology and become personally acquainted with bugs and worms, though I could never see what the Lord made them for, except in the case of crickets and red-worms for fish bait. I found out I would have to study biology to know what to buy, cronology to know how to keep the crows off, astrology to know when the moon was in the right place for the seed, geology to know how to guide a mule, and pathology to know how to make the business pay. I crammed like a sophomore trying to grease through a commencement examination.

During the time I was going through these scientific researches I noticed every day a poor man passing my place, driving a dump cart, hauling manure. He was going to "truck-farm," as he vulgarly called it. I was sorry for that man. He was very poor, with a large family—sixteen children, all boys, but fifteen. I thought it would be an act of Christian charity in me to dissuade him. So one day I stopped him and said: "John, is it not rather a hazardous business for you, with your large family, to undertake a scientific occupation like this? Why, my dear fellow, you do not know the difference between a rhynchophores (*curculio imperialis*) and a trilobite of the early zoic era." He said: "No, I don't. But I tell you what I does know. If you puts plenty of manure on the ground and works it right, it always fetches truck." Of course, I reasoned no longer with such gross ignorance.

Well, time flew on. I had a world of beautiful plants. April came at last. I got a regiment of negroes and put them in the field, and such a field. It was a lovely, red, stiff clay, that might have sprouted a pea if the pea had not first opened its eye to see what kind of soil it was in. Toward the last of April I

saw a little yellow, sickly bloom. I stuck a stick up by it and walked round and round it every day, putting in my botany. Would even go out at night to see if the "sweet influence of the Pleiades" was doing it any good. About the fourth night a remorseless worm came up out of the earth and it was no more. But the amount of entomological satisfaction I had in dissecting that worm fully repaid me. A drouth came on in may. The plants got sick. So did I. By the middle of July I was through with the crop, or rather it was through with me. For my six months' labor I realized the magnificent sum of \$1.80.

In that day of tribulation I found out there was one ology I had not studied, but which I needed more than any—that was theology. If my wife had not been a Methodist I would have "cussed." I heard that many did "cuss," but it was mostly me, for all had followed my advice and example. There was one man who did not "cuss." It was the poor man who drove the manure cart and who did not know the difference between a rhynchophores (*curculio imperialis*) and a trilobite of the early zoic era. He made money. But I had one year's experience. I made this entry in my memorandum book: "Tomatoes need rich ground and plenty of water." I determined to try again. The next year I put a ton of cotton-seed meal to the acre, harrowed the ground flat and dammed up every place where the water could be held. I then waited for the rains. They came in the greatest abundance. It was the spring when the people of Cincinnati took to the tree tops to get out of the way of the Ohio River. I was happy. I waded out to see my plants swim. They looked nice for about five days, but when the waters subsided and the sun came out hot they got sick. So did I. When I gathered and shipped the crop I balanced my book and found I had lost \$200. But I had another year's experience. I was getting a little shaky, but I determined to try again. I dared not quit. I stood appalled before the storm of ridicule which I saw gathering in the eyes of the ungodly jesters. If I failed again I would have more time to prepare to skip the town. I made another entry in my memorandum. It was this: "Make a garden of your land; drain well; treat as you would a garden and plant many things."

The third year I moved as cautiously as a kitten in paper shoes. I put one acre in tomatoes, about the same in cucumbers, a smaller area in beans, cantaloupes, Irish potatoes, radishes, spinach, etc. I succeeded beyond my expectations. I found money in every crop. The cucumbers brought about \$150 to the acre; the cantaloupes at the rate of \$250; the beans about \$180, and from the one acre in tomatoes I sold over \$900 gross. They were shipped mostly to Chicago and Minneapolis. I was satisfied now. I need not fly to the frontiers an exile. I had saved my reputation and demonstrated the fact that there was money in dude farming.

In giving my experience I hope I have pointed several morals as well as adorned a tale. First, that dude farming is a business which a man must learn before he can hope to succeed; second, that "if at first you don't succeed, try, try again;" third, that in proportion to acreage it beats any other crop, not excepting butter.

The extent to which this business will be carried on in the near future can hardly be estimated. It is increasing rapidly in the far South, along all the trunk lines. They are fostering the industry. But there is one fact that must be patent to everybody. The business must move south of the Ohio River. The growers of Illinois cannot fight against latitude and the warming influences of the sun. The Illinois Central Railroad is building refrigerator cars, and I hear it is putting up an ice factory at McComb City to ice them. This will enable Southern growers to ship the entire crop, even in the heat of summer. They will thus get the cream of the early market, and will remain in to lap at the blue milk of low prices.

This may seem unjust to the growers north of the Ohio River. But if the Central road does not do it other trunk lines will, and the result will be the same. But the Northern growers need not be unhappy. It will be easy for them to fold their tents and follow the robins in their autumn flight. There are millions of cheap acres awaiting them in the South. They can take with them their energy, skill and experience, and reap fortunes in the South, not only in this but other diversified agricultural pursuits. They need not be afraid to come. They need

fear that the lordly cotton planter will look down upon them in scorn. He is not so lordly as one might suppose. Besides, the Southern people love farmers. Agriculture is a specialty in the South. Farmers are looked upon as God's people, living as they do so close to nature and drawing their sustenance directly from the breast of mother earth, God's footstool. They love farmers, no matter where they come from. No matter whether they come from the far distant South, where the soft zephyr steals in from the rippling gulf to kiss the sweet-scented blossom on the orange tree, or whether they come from the far Northwest where the howling blizzard sweeps down and bites the last potato in the cellar. We are all one, bound together by a common sympathy and a common interest. They look upon the farmer as the great conservator of the Republic; the bulwark of the nation; the foe of all disorder, of socialism, agrarianism, nihilism.

Every government on earth finds its security in the strong arms and peace-loving hearts of the unappreciated, toiling farmers. Communism in Paris fell dead at the feet of the farming classes of France. They form the balance-wheel which moves the machinery of the world. Every steamer that threshes the waters of the ocean, every engine that throbs along our iron highways, moves with its ponderous arms the products of the farmers' labor, carrying bread and meat and butter and sugar and cotton and turnips and beer to the hungry and naked throughout the universe. I mention turnips in that category, because I must not forget the products of the dude farmers. All human existence and happiness is dependent upon the farmer. The loveliest city belle, who dozes away her dreamy life in her perfumed boudoir, the fair lily who glitters in her diamonds beneath the electric lights, would hunger and die but for the farmer, who raises her buck-wheat cakes, and goes out in the cold to milk the soft-eyed Jersey, that she may be supplied with eleomargarine. I am afraid, from the way you laugh at me, that I have made a mistake. I do not know anything about butter, but the conclusions I drew from to-day's discussion was, that it was the Jersey cow that gave the oleo-margarine.

The city folks and the professional classes often poke fun at the farmers. They regard them as innocents. They are never supposed to be competent for anything. In the distribution of the tens of thousands of offices they are never thought of. When did you ever hear of a farmer going as minister to some foreign court? Or as consul to some foreign city? How many of them get into postoffices, land and revenue offices? But they do not kick up a fuss and try to take the administration by the ear. The farmer is never remembered except by the tax-gatherer, the reaper Death, and his Congressman, who now and then sends him a paper of beet seed and one of his speeches on the tariff or silver question.

You have all heard to-night the beautiful poem recited by my fellow-townsmen, Mr. E. L. Ross, the Mississippi laureate. We are all poets down in my town. We can't help it. The air is so laden with the perfume of jessamine it hits the nose with such a passionate sweetness. Our women are so beautiful, the air so balmy, and all nature so luscious, we cannot help being poets. I am a sort of poet myself, but I don't write it, I just dream it, and I have been dreaming to-night while sitting here looking over this vast throng, brought together from every point in this great valley.

My eyes have been wandering from face to face, but they have always rested with most interest upon those heads which are showing the silver threads. I see before me those who, in the late war, wore the blue, and those who wore anything they could get hold of. I have wondered if that old fellow over there was not the very man who dropped me at Malvern Hill. Why may not yonder old codger be the man who shot me in the heel, when I was running up the Shenandoah Valley with Jubal Early? That sounds bad, but I venture to say there is not a soldier here, from either side, if he was there all the time, but will admit there were occasions when he had to make tracks to the rear, and the wider apart they were the more satisfaction they gave him at the time. I have seen moments when I have wished I could make tracks a mile apart going one way and a half inch apart going another. Over there I see a lean and hungry-looking man, who, no doubt, was with

us in East Tennessee when we were living on parched corn and patriotism, trying to starve the army of Burnside at Knoxville. It was starvation trying to starve.

But I tell you, my Northern friends, if we had only had one more ear of corn in our army and the outside Federals had let us alone we would have succeeded. I wonder if a certain cute man I see over in that corner is not the one who once seduced me out between the picket lines to swap ground coffee for tobacco, and who palmed off a little sack of sawdust on me for my good plug. The Lord knows I wish I could meet that man. I know the Federal soldier who stood by his flag and fought me like a gentleman and scholar. I respect the man who stood to his gun and made me bite dirt at Malvern Hill. I forgive the man who took advantage of the time when my back was turned to bore a hole in my heel, but if I can ever meet the man who put up that job on me, I will plaster a forty-acre farm with his gore.

We all went this morning to visit the public schools of this lovely city. We were all delighted, and could appreciate the just pride which Jackson feels in her admirable public school system. We stood there and watched the 800 children, boys and girls, going through their calisthenic and other drills and marches, but I could not help wondering if the old blue-coats present were not saying to themselves: "What in thunder are these little rebels drilling so for?" In answer to that thought, I can say they are drilling in the arts of peace. The boys are learning to march, that at some future day they may march northward and capture the sweet daughters of those who fought their fathers; and the girls are learning to march, that they may go gracefully to the altar, when captured by Northern boys, while the old veterans of both sides, their heads bowed by years, the past forgotten, will exclaim in unison: "God bless you, our children, and may you grow up in happiness to know only one God and one country."

I wish to say before I close that I am not here drumming in the interest of any locality. I take pride in the prosperity of any community in our common country. I wish to see the whole South built up. I wish to see Northern men settle

among us. I cannot say they will find anywhere a lovelier country than that which surrounds this beautiful and hospitable city. I will only say that when you have filled up this country you will find around my own little city of Canton, Miss., just such a land and country and people as you find here, ready to receive you with open arms.

That is all I know about dude farming.

Just as Colonel Dudley was closing, the venerable figure of

COL. ROBERT I. CHESTER

was noticed in a remote part of the hall, and loud calls being made for him, he was compelled to allow himself to be escorted to the platform, when Commissioner McWhirter introduced him to the Northern visitors as a bill of health for West Tennessee, which was done amid tremendous applause. Colonel Chester is a well-known character in Tennessee. He was born in 1793, and is a veteran of the war of 1812. Having lived in Jackson since 1823, he is naturally well-known there by every man, woman and child.

Though 93 years old, he is as brisk as most men of 60; his voice has none of the tremulousness of age, and his eye is as bright as ever, the writer having had several letters from him written without spectacles.

Upon being presented to the audience—which he thought very unnecessary, for he knew everybody in it, he said—Colonel Chester said his wish was that all his hearers might have health, happiness and prosperity, and live a hundred years, and that he might live to see every one of them die. He then entertained his audience with numerous interesting reminiscences, and after speaking a few moments, retired amid much enthusiasm.

SOUTHWEST LOUISIANA AS A HOME FOR NORTHERN FARMERS.

An address of special interest to the Northern visitors was that of S. L. Carey, Esq., of Jennings, La. We give the speech, which was very brief, in full :

“Southwest Louisiana as a home for Northern farmers.” When I speak of Northern farmers I should take this text, “They who turn the world upside down have come hither also.” They have marched to the front and led the way of civilization in all countries. Wherever you see fine farms, fine stock, good buildings well painted, and other evidences of comfort and thrift, that is the work of those who turn the world upside down, who tickle the earth with plow and hoe until it laughs with the harvest. These men have conquered forests, crossed oceans and rivers, overcome drought, water infertility, overcome obstacles and made them stepping stones to success. They have marched from Asia and Africa, through Europe, crossed the ocean, started the plow at Plymouth Rock, turned a straight furrow to the Rockies, then to the “Golden Gate,” and, like Alexander, were about to weep because there was no more land to turn upside down when they heard the words of Moses in Exodus: “Get you up Southward and among the Canaanites (Acadians) who dwell by the sea and by the coast of Jordan.” They returned with grapes, and they brought of the pomegranates and the figs.

What has Southwest Louisiana to offer such men? First and foremost, health; and when I say to this intelligent audience that this country situated on the north coast of the Gulf of Mexico and on an open prairie, fanned by winds that have traveled over salt water thousand miles, the last trace of impurity gone, thus the Gulf coast waters never stagnate for her islands ever are saltier than “Lot’s wife.” We get the first use of this air fresh from the water. Do you still want the evidence of the oldest inhabitant? then I say statistics show more old people here in proportion to population than elsewhere in the States. Do you want the experience of our settlement started three years ago; our death rate has not exceeded six per thousand;

one-fourth the rate of Illinois or Iowa. Southwest Louisiana offers good water; all our people use well water, it is clear, pure and generally soft. We offer good grass, and grass is king; grass will make rich land and rich farmers. Our best grasses propagate by seed and root at each joint. Hay can be made from June to December, and has a net cash value of \$5 per ton at nearest railroad station. Land can be bought at \$1.25 per acre, and without plowing, seeding or cultivating, will pay interest on \$100 per acre. She offers the finest timber in the States, and lumber from \$5 to \$20 per 1,000 feet; good hard pine lumber in the midst of our settlement at \$3 to \$8 per 1,000. She offers Florida climate with a clayey loam soil and clay sub soil. She offers a great variety of fruits; most fruit trees grow from cuttings; fruits raised on clay soils are best flavored. Fruits and fruit trees have few enemies, and trees grow rapidly nearly the entire year. Peach trees often live and bear fruit forty to fifty years. Fig trees live way beyond the years of man. And once figs always figs. We read of one barren fig tree at Jerusalem, but none in Louisiana.

We all know the advantages of farming in a prairie country; here are over 3,000,000 of acres of prairie too high for overflow and too flat for wash.

No conflicting or disturbing elements on this prairie, you have only to improve the vast herd of wild cattle and horses, fence in stock and grass and go to making half money, for this is the poor man's cash crop and will do far more for us than the discovery of a gold mine. Fully 6,000 car loads of hay rot on the ground, within a radius of five miles of Jennings, Calcasieu Parish, La., every year. She offers you cheap transportation by water or rail to near by and generous markets. And last, but not least, we offer you a cordial welcome. In the words of Longfellow, herdsmen, "Welcome once more to a home that is better perchance than the old one."

Here no hungry winter congeals the blood like the rivers, smoothly the plowshare runs like a keel through the water. All the year round the orange trees are in blossom, and grass grows more in a single night than in a whole Canadian summer.

DIVERSIFIED FARMING.

BY HON. B. A. ENLOE, OF JACKSON, TENN.

The above was the tittle of a most delightful humorous address delivered by Hon. B. A. Enloe, of Jackson, Tenn.

He kept the audience convulsed with laughter throughout the entire speech, of which we regret our limited space will only allow us to give a few extracts:

Adam was the first diversified farmer mentioned in history, and while there is nothing of record to show how many pounds or how many bushels he produced per acre, it is reasonable to suppose that he was the most successful farmer of his day, since he cultivated a virgin soil, "the garden spot of the world," and didn't owe any man a dollar. While he respected nature's great law of diversity he prospered and was happy, but when he made a specialty of the apple he lost his inheritance, and his posterity have not regained it to this day.

The speaker classed himself as a suburban farmer, and said, since he had adopted that style of farming he had taken on more observation than experience, and it is his observation that you can always get more information of some sort out of an observational farmer than you can get out of an experimental farmer. When a man can't farm in any other way he will farm with his tongue. Anybody can tell you more about it than the man who is actually doing the work, but the value of the information is another matter. He thought that valuable observation and experience should be put up in small packages and distributed on the principle that our Congressmen distribute garden seed, where they do the most good. He said among suburban farmers there is a marked partiality for rye, and the best methods of consumption claimed more attention than the best methods of production. That the rural farmer chiefly values rye because it is a good crop for winter pasturage, but his suburban brother considers it good grazing all the year around, and especially when it acquired the title of "old rye." The four-

Ag

mile law in Tennessee was intended to confine this idea to the incorporated towns and cities of the State, where the discussion of the subject still continues with spirited interest.

He said wheat is a good crop for this country when it hits, and it hits better for some people than it does for others. It generally misses for the man who sows in November or December on land that has grown the past season a mixed crop of grass and corn or cotton, especially when the grass and the corn and cotton stalks have been partially scratched in to give the wheat a footing for the winter campaign. He referred to corn as one of the original inhabitants of this country, and said our first knowledge of it dates back to the time when Columbus discovered that the Indians raised it, but with the assistance of our aggressive civilization we have developed this product to a point where it raises more of them than they do of it. He said the bulk of the crop was planted in the spring of the year, though about Christmas, picnic and election times seems to be the favorable times for extensive planting. That the most generally-accepted theory for pleasant tillage, and perhaps the most popular practice with city farmers, is to cultivate it with a spoon and raise it in a glass. It keeps well in jugs at all seasons of the year, except when evaporation strikes it, which generally happens sooner or later when it is put up in this form. The logic of experience says don't put your corn in jugs, though since the passage of the four-mile law in Tennessee there is more corn shipped to consumers in jugs than at any previous time in the history of the State.

He said much evil had resulted from our cropping with corn, but he had confidence in the value of experience as to the better methods of handling corn. Speaking of cotton, he said: It is a good crop to grow in your imagination. It is a good crop for your neighbor who refuses to join fences with you. It is a good crop for Egypt. It is a good crop, perhaps, for any country that is hot enough, with perhaps a single exception, and that is an undiscovered country from which no traveler has ever returned, and Henry Ward Beecher insists that it is even too cold for cotton, or words to that effect. That, he said, raised a geographical question, which has no direct bearing

with the subject in hand. He said some farmers in Tennessee could make money raising cotton; but it was those who do not bet all the year's toil on the cotton crop. My advice, which is about all I have to put in the contribution box, because as an editor it constitutes my principal income, is, if you must and will plant cotton, plant it "in the dark of the moon." If you have no land in that quarter of the moon, plant it in the full of the moon. Mind the distinction, it is the moon that is to be full, not the planter. A mistake right here is often fatal to the crop. Be sure you plant it somewhere in the moon if you expect to make it a profitable crop in Tennessee for exclusive or general cultivation. He said some one had compared the Tennessee cotton planter to the man who was holding the wild-cat—it was difficult to hold and dangerous to turn loose, but his advice would be to turn loose from a tail hold and get off as speedily as possible.

He said in the vegetable line the Irish potato holds undisputed sway over the popular heart, and one of the chief pleasures attending the cultivation of it is the element of delightful uncertainty there is about it. You can always calculate with reasonable certainty as to a good crop of potatoes or bugs, and the beauty about it is that no human calculation can tell which. You may plant potatoes and they will bring bugs, but you may plant double the quantity of bugs per acre and they will not bring potatoes. He said that the Irish potato was originally used for raising orators, and we are indebted to this vegetable for some of the grandest names in the civil and military history of the world. While potato-growing was an "infant industry," struggling for adequate protection against the "pauper labor" of the bugs, potatoes commanded good prices, but when the bug got missed, prices went down to zero. Manufacturing them into starch to be used in stiffening the market price is suggested as a remedy. Speaking of grass, he said everybody who grows anything, grows grass. Some grow it because it is easier to let it grow than it is to prevent it. Sometimes you cannot. In the absence of a personal acquaintance with the condition of the horses and cattle is a good indication to go by. If they are fat it is most probably a grass crop. If they are poor it may be a cotton crop. When it is a grass crop the

owner has a corn-crib and a smoke-house nearer than Chicago, and he may have a mortgage on some of the neighboring fields. If it is a cotton crop the chances are that he has a mortgage on his own.

Clover and grass are powerful agencies in this country, and they have pushed the mortgage off many a farm where the mortgages were deeper than the soil, a few years ago. Speaking of mortgages, the place to plant them is on your next neighbor's land. (Some confusion in the audience interrupted the speaker. He paused a moment and said: "I would also recommend the cultivation of a small crop of politeness for use on public occasions.") Resuming, he said a mortgage is the only thing we have ever found in this country that will grow faster on poor land than it will on rich land. Cotton and mortgages frequently thrive well together, but clover and grass choke out the mortgages and make the soil too rich for them. Speaking of the spontaneous production of the soil, he mentioned the blackberry. He said this fruit is distinguished above all others, except the apple, not so much by name as associations. The curse which the apple brought upon the race through Adam brought the brier into existence, and the blackberry is the compensation of the evil wrought by the brier. This delicious fruit, with the assistance of the watermelon, has done more to promote individual liberty and summer recreation among our colored population than the Twenty-fifth Amendment to the Constitution of the United States. In speaking of the use of the blackberry, he recommended its use because it is free from the deadly suspicion of flies. While flies have been found in everything else, there is not the man, woman or child living who has ever found a fly in jam.

He indorses the cucumber as a defensive weapon of warfare and said, once introduced into the ranks of an invading army, it would inflict more punishment on the enemy at short range than a Gatling gun. He said watermelons are most successfully raised at night. They are oftener planted in boys than anywhere else. That he had never been able to believe in this by experience or observation, but many melons had been planted to the boy. He stated that according to the census report it ap-

peared that the poultry crop was worth more than any single product of this country, but this would be a very narrow view to take of the subject, considering the direct influence of fried chicken on our civilization. He said that while Tennessee can and does produce the greatest variety of agricultural products, with moderate success, she is not prominent in the production of any.

Anybody can tell you how profitable it is to raise Berkshire hogs, Jersey cattle, Shorthorns, Holsteins, and Southdown sheep, but I insist that this is not the only view of the subject. When we go back to trace up the footsteps of nature we find that the razor back was the aboriginal hog of our forests. He is the speediest of all the hog family, as well as the most enterprising. In his natural state nothing could catch him. To this day he can outrun a hog thief, on a dead level, and he is the only hog adapted by nature to an exclusively cotton-growing country. - He can jump through the crack of a fence four inches wide, on a full run, by a simple twist from a perpendicular to a horizontal position. If meat and beauty are objects worth striving for, you will no doubt, choose some of the high-bred aristocracy of the still-house and swill-tub, but if you want the unadulterated hog, fresh from the hands of nature, and able to make his way through the world against all odds, stick to the "razor back."

THE STANDARD-BRED HORSE.

BY J. W. MILLER, WINTERSSET, IOWA.

In order to place the breeding of the trotting and roadster horse on a more intelligent basis and to lay the foundation on which to establish a breed of trotters, the National Association of Trotting Horse Breeders framed and adopted a set of rules known as the Standard of Admission to Registration. These

rules were based on the two-thirty performance, and were designed to indicate a concentration of fast trotting blood in all those animals that met their requirements. The standard has now been before the country about ten years, and during that brief period it has so fastened itself on the public mind and demonstrated its inestimable worth to the breeding interests that to-day it is accepted as the true gauge of trotting blood from one end of this broad land to the other.

At first there was much opposition to it from a certain class of breeders whose stock was left just outside, but they have been swept before its irresistible march and have been compelled either to abandon their business or fall into line.

The standard horse is fast becoming the necessity of numerous classes of people. He is essentially American, and whatever is American, Americans must have. The business man demands him, and insists that no horse will take him to and from his business with as much dispatch and safety. The family carriage is un-American without his stately presence before it; for, it is argued, he is a representative harness horse; he descends through a long line of noble and intelligent ancestors, trained and restrained by man, until in him is reached perfection in docility, obedience and tractability—in his care the family is entirely safe. The gentleman road driver belongs to another class, that represents intelligence, a high discriminative power and immense wealth. They will have nothing but the standard trotting-bred horse. He furnishes them pleasure, recreation and oftentimes a new lease on life. He is loved above all other animals, and the bond of friendship that exists between the horse and his master is next to that of the family circle. The most fabulous prices are paid for him on account of his speed, beauty and amiable disposition, and, we might add, to no other person does he owe more for his existence to-day, than to the gentleman roadite.

There is another business on which the standard horse has a monopoly; in which he brooks no rival, neither will he tolerate competition, and that is on the trotting course. Here he reigns supreme, and his sovereign rights are absolute and undisputed. Here he also asserts his Americanism, as he is the chief actor

in the greatest of American sports; on him vast sums are spent, both legitimately and otherwise, for we are sorry to say he, like all good things, even to the pulpit, is sometimes prostituted to unholy uses, and it is made the machine of gamblers and thieves, but through no fault of his. Depraved man is his worst enemy.

It is not for me to tell Tennesseans how to breed the standard horse. You are already abreast of the foremost in advanced breeding, and your many noted productions tell the story of your sagacity and enterprise far more forcibly than can be done with the pen. That you have grasped the great and true principle in breeding, "that like begets like or the likeness of an ancestor," is apparent by your works. Still a word or two on the subject will not be out of place.

The problem of how to secure the highest type of the standard horse, which, in plain English means the fast trotter and perfect roadster, is by a great ways yet unsolved. The ideal horse should be perfection in light harness; he should also be able to trot his mile close to two minutes, and repeat a little faster. Handsome, pure-gaited without the use of appliances, and with intelligence and spirit so blended together as to make him obedient at all times, while possessed of a nervous organization that never lags or tires.

The much discussed question of whether or not the thoroughbred blood is of advantage to the trotter in producing and sustaining speed at the trot, will, we think, settle itself before long. The thoroughbred horse is one who has been bred and trained for generations to immense exertions and sustained effort at the gallop, which powers have been highly developed in him, and the intensity and fixity of these characteristics renders him abundantly able to transmit them to his progeny. This high state of development of the lungs, heart, arteries, veins and muscular tissues is all he has that is of any benefit to the trotter—all else is dead weight. His inclination to break into a gallop when hard pressed, and his total lack of trotting instinct is the rock upon which many a promising trotter has been wrecked.

But the settlement of this question will come when we have a standard *trotting*-bred horse whose internal machinery has reached this high state of development through generations at the *trot* instead of at the gallop. This horse will possess all the staying qualities of the thoroughbred, because he will have attained them through the same process; he will also have his beauty of form and finish, endurance and spirit, with docility and tractability added, and, more than all else, he will have the trotting instinct and trotting brain, to which the racer is an entire stranger. When this sort of a horse is produced, the standard bred trotter will have reached the distinction of a separate breed, and he will be the light harness horse of the world, just as the thoroughbred is the saddle horse and the Percheron the draft horse. And the enlightened breeder of trotters would just as soon think of introducing the blood of the latter into his harem as that of the former.

The standard horse is the coming horse among Americans, because he is so practical and adapted to so many uses. He is growing alike in favor and form, and the progressive breeder, with brains and energy, who applies himself the breeding of him, has success already assured.

Tennessee has the requisites for his propagation to a high degree. Your salubrious climate is greatly conducive to early development at small cost, and there is no serious reason why you should not soon be among the foremost, if not indeed the foremost, in breeding the best representative of the most noble of all animals.

HORSE TALK.

One of the most interesting and instructive addresses of the occasion was that delivered by S. D. Thompson, Esq., of Wayne, Du Page County, Ill. Mr. Thompson is an able speaker, and carries with his words the conviction that he knows what he is talking about.

THE BIG HORSE.

Practically, the question of breeding horses presents three leading aspects to the farmer of the Mississippi Valley :

1. What sort of horse is best adapted to his use?

2. What sort of horse is best to sell?

3. Having decided what type of horse is best suited to his purpose, whatever that may be, how can he breed such horses with the greatest degree of certainty?

We might enlarge these divisions of the subject so as to include questions of feeding, training and general management, which, of course, are practical questions, but the three first-mentioned are the principal ones, and even these may be summed up in the general question, What sort of horse is it most profitable for the average farmer of the Mississippi Valley to raise?

The branch of the horse-breeding business that possesses the greatest fascination, especially to the young man, is breeding for speed, and nearly everything that is written or said upon the subject of breeding horses at all, is said or written from that standpoint. The papers each year are full of the performances of a Maud S. or a Jay-Eye-See, and with each successive racing season men go wild with enthusiasm over the splendid victories of a Foxhall or a Ten Broeck. Robert Bonner pays \$40,000 for a Maud S, Jerome I. Case \$29,500 for a Gov. Sprague, and forthwith every farmer boy who finds a colt on the farm that can trot a little faster than some of the old work horses on the place, is smitten with the idea that in that colt he has an embryo Phallas, Maud S. or Jay-Eye-See. These exceptionally great performances on the turf, and the exceptionally high prices paid for great performers, have somewhat the same effect upon the country at large that the accidental drawing of a prize in a lottery has upon the people living in the immediate neighborhood of the lucky man. Every one who can scrape together enough money to buy a ticket in that lottery forthwith invests it; and so every man who is engaged in breeding horses thinks that he will be the lucky man that he will raise a world beater. There is this difference, however; the young man who already

has a promising colt is morally certain that his is the ticket that will draw the capital prize; consequently, he spends the time that would be better employed in plowing corn or hoeing potatoes, in training, grooming and rubbing that colt, and his "old man" spends the money that was laid up to meet the interest on his mortgage or to pay his taxes, in buying sulkies and harnesses, and toe weights, and knee boots and quarter boots, and numberless other sorts of boots for this colt that is destined to eclipse the fame of Maud S. or Jay-Eye-See. There is a fascination about it that is well nigh irresistible, and when once a young man (or an old one either, for that matter) has become possessed of the idea that he has a trotting horse, you may bet your last pair of boots that the idea will retain possession of him until he is beaten out of a good share of his surplus greenbacks.

My connection a few years ago with a journal devoted exclusively to stock breeding brought to my notice scores of letters asking for advice upon various topics. Many of those letters pertained to the trotting horse. In most of them I found accounts of very promising colts that were said to show a wonderful burst of speed; able, without any training, to trot right away from anything in the country. In most of these letters, advice was asked as to whether it would pay to train these wonderful colts, and how fast they could probably be made to trot. To all of these letters the usual answer was: We do not advise any general farmer or ordinary breeder, to spend much money upon training trotters for the turf. A limited amount of training for this purpose by a competent person, may be beneficial; but for every dollar returned from an investment of this nature, ten have been lost. When a farmer sends his colt to a professional, or employs a man for that special purpose, he labors under many disadvantages. It is natural that the trainer should encourage high hopes as to the promise and improvement of animals confided to his care, for upon this his living depends; but I would advise all breeders under such circumstances, to keep a sharp look-out and never place themselves at the mercy of a professional trainer by relying implicitly upon his judgment or integrity. Not that professional trainers as a class are more dishonest than other men, but simply

from the fact that the interests of the breeder and those of the trainer, are frequently antagonistic. The latter, unless his reputation is sufficient to bring him all the business he cares to have, is interested in keeping the animal as long under his control as possible, thereby giving himself employment, and frequently reaping a handsome profit on the keeping, and in nine cases out of ten, the expenses will soon exceed the value of the animal.

It is one of the peculiarities of the business that every man should exaggerate the value and promise of his own horse. To use a slang phrase, but a very expressive one, I know how it is myself, I've been there. I have also seen many of my friends in the same condition and have noted the effect upon their purses. The situation was tersely expressed by a friend of mine, who upon a certain occasion was listening to the glowing account a third party was giving, of the wonderful promise of his little bay mare, that, without any training to speak of, could trot in 2:50. My old friend heard my young friend through, then shrugged his shoulders and said: "So you have a 2:50 trotter, have you, and you intend to have her trained? Well now, if you will go and buy a cow that sucks herself, you will have two pieces of property about equally valuable." And my young friend afterwards found out to his cost that it was true.

We meet cases of this kind almost every day, nearly every neighborhood has some of these horses of wonderful promise that are supposed to show marvelous bursts of speed. Their unsophisticated owners imagine that they possess the favored one, that is, to "set the world on fire." They put the price up in the thousands, spend hundreds of dollars upon training, buy boots, and straps, and toe weights, and bits without number, talk horse on every street corner, attend races, read the *Spirit of the Times* and *Turf, Field and Farm*, more closely than they read the Bible, and imagine that the royal road to fame and fortune lies straight before them, and that they are traveling upon it with a trotting horse at a 2.20 gait. You see one of these enthusiastic men next year, his ardor has perceptibly abated, he talks less horse, and when you ask him about his

wonderful trotter he talks about the crops or weather, when pressed he reluctantly tells you that his mare has gone amiss, a little lame or tangled in her gait, and he has concluded to give her a season's run at grass. You see him again the next year. He has lost all interest in turf sports and denounces them on account of their immoral tendency. He has quit taking the *Turf* and the *Spirit* because he thinks the influence upon his boys is not salutary; and when you ask him what has become of the little bay mare, he looks absent-minded and at once remembers that he has an urgent business engagement around the corner.

This is no fancy sketch; the shoe will fit hundreds of cases in various parts of the country, the legitimate result of the disappointment which, in nineteen cases out of every twenty, follows the exaggerated hopes of those who breed or train trotting horses. There is any amount of fun in the business, but precious little profit.

The conviction grows stronger upon me with each year as I review the records of the previous season, that the breeding of fast trotting horses must be left to gentlemen of large means, who, by the selection of the choicest strains of blood in both sire and dam, and by superior facilities for breaking, training and selling, may meet with a measure of success that will warrant its continuance as a business.

This has for many years been true of the business of the breeding of running horses in this country, and it is each year being concentrated into fewer hands. A half dozen breeding establishments furnish 90 per cent. of the race horses that appear on the American turf, and general farmers cannot compete with such establishments with any prospect of success. They cannot afford to train for themselves; they have but few opportunities for selling; and even were they able to secure brood mares of the choicest strains, and secure the services of the most renowned sires of racers, they would be at a decided disadvantage as compared with such establishments as those of Mr. Alexander or Mr. Lorillard.

The breeding of trotting horses is gradually working into the same condition, and will, in my opinion, ultimately become as

circumscribed as thoroughbreds, in proportion to the demand. Judgment in the selection of sires and dams, and in coupling, sufficient means to buy the choicest representatives of the best strains of blood and to command the service of skillful trainers, will effect the business of breeding trotting horses as it already has that of breeding thoroughbreds.

It is important to bear in mind that for racing purposes, only the best are valuable; only those that can go to the front in fast time and stay there, will command top prices; and as the average speed of the American trotter increases, so the measure of value changes. Only a few years ago, a horse that could trot three heats of a race in 2:30 was considered a valuable horse for the track and would command a long price, now, one that cannot show a trial of three heats below 2:21 is not considered worth entering in even the slowest classes of the grand circuit. No matter what may be the measure of speed which constitutes the first-class trotter, only those that fill that measure will command top prices; and those that fall below it will possess little value.

To control the breeding stock farm on which extreme cases of speed are most likely to occur, will require capital to start with, and still more to carry on in a profitable manner. The chances for the mere dabbler in the problem are too few and far between to be worth maintaining, and general farmers may as well give up the unequal contest. They may breed 2:30 or 2:40 horses, but it will not pay them, and it may be set down as a positive truth that in nine cases out of ten where a farmer breeds a colt that shows exceptional speed, he will spend five times as much in training that colt as is ever realized on the horse. It is scarcely worth while to discuss the question of what is called the thoroughbred horse. By the thoroughbred I mean the race horse, or blood horse as he is sometimes called. As before remarked, the breeding of these horses is confined mainly to a few large establishments in Kentucky and Tennessee, and one or two establishments near the Atlantic coast. Very few farmers in any part of the country venture to breed these horses. The demand for them is limited, being confined almost exclusively to racing purposes. As Oliver Wendell

Holmes expresses it, "The racer is incidentally useful, but essentially something to bet on," and for that purpose he is bred, raised and sold. They are incidentally useful, as I have before said and written, for the purpose of crossing upon other strains to give strength and endurance.

But, to my thinking, the thoroughbred is not the horse for the farmer to breed to. As a matter of fact they have been bred for centuries with an especial view to the race-course, and as a result we find that they have been perfected to a wonderful degree of speed, stoutness, energy and resolution as a breed. But with these qualities there have been perpetuated, and perhaps intensified, some vices as a restless, nervous, excitable temperament, which certainly is not a desirable quality in a farmer's horse.

If the object of the breeder is to produce horses especially adapted to the carriage, I cannot too strongly recommend a French coach stallion, provided, always, that the mares are of a good size. The trouble is that few of our miscellaneous bred mares that have more or less foreign draft blood are large enough to produce good carriage or farm horses from such sires. The same remark applies to the thoroughbred and trotting sires. However, the farmer by breeding to that class of horses will, with care in the selection of sires and dams, produce a few stylish and high-stepping, good-sized horses that will command a good price as carriage horses. The best horses of this class will always sell readily and frequently bring very high prices, but with the greatest care in selection and breeding that the average farmer will be able to give, he will find a large proportion of the horses produced from such a course of breeding too small, or else lacking in style, to fill the requirements of a first-class carriage horse, and he will find an accumulation of unsaleable horses on his hands.

But it is certain that very few farmers can afford to breed two classes of horses, one to use, and another to sell, and practically, the farmer will find it most profitable to raise horses that while they will do the work of the farm well, can at any time be sold at a remunerative price. In other words, he should direct his breeding into the channel that will produce

the greatest proportion of saleable horses; for after all, that must be the chief consideration. And here he will do well to remember that the demand is constantly for heavier horses than the market affords.

The demand for greater size is apparent in the horses that are used in all the great cities, by the omnibus, baggage and express wagons, the heavy truck, and the dray; and there is absolutely no demand for small horses unless the possessors of extraordinary speed. No matter how many of such horses a farmer may have on hand, nor how cheap he may offer them, he cannot find purchasers. On the contrary, the farmer who has the good judgment to raise horses weighing from 1,200 to 1,600 pounds, of fair average quality, has no difficulty in finding a market.

This fact ought to teach an impressive and practical lesson. As before remarked, the general farmer cannot afford to breed for speed. He must leave that to the gentleman of means, who, with the choicest brood mares, as well as sires, and with every appliance for successful training, can engage in the lottery of breeding for speed, because he can afford to take the chances; and because he finds a considerable portion of his reward in the relaxation from other cares which this business affords. But the general farmer must raise horses that he can sell. He must do the work of the farm mainly with mares that, while performing their labor satisfactorily, will each year produce colts which at four or five years old will be saleable horses. He must keep such brood mares as when coupled with good stallions will invariably produce horses that answer the demands of commerce.

There ought to be no practical difficulty in doing this. If the mares be quite large enough with a dash of good blood, they may be coupled with a well-bred, large trotting stallion or thoroughbred, with a considerable degree of certainty that the produce will be good coach or carriage horses. But, as a general rule, the farmers of the Mississippi Valley with their miscellaneous bred mares will be most successful if they confine their breeding to draft horses. With good Percheron draft horses for sires, 75 per cent. of the foals from ordinary mares

will make horses that in fair flesh will weigh 1,400 pounds or over, at maturity; and such horses, unless seriously defective, will always sell at good prices. There is no expense for training; the colts are broken by the farmer in doing the farm work, and as soon as they are old enough, are ready for the market; and such horses can be raised as cheaply as a steer to the same age. It will cost a little more at the outset for the service of the stallion, because good imported horses such as I have described cannot ordinarily be bought for less than \$2,000, and such stallions cannot be kept at less than \$20 service fee. But this small additional outlay is scarcely worth taking into account when it makes all the difference there is between a colt that will sell readily as a four-year-old for \$150, or more, and one that cannot be sold at all.

That the Percheron is to be preferred to the sluggish and lymphatic draft horses of Northern Europe, there cannot be a doubt. The infusion of warm blood through their Oriental origin, gives them the courage and staying power of thoroughbreds, while the very consanguinity of their breeding for the past century, has so thoroughly intensified the good qualities inherited from their Arab ancestry, that they are more potent as sires than that of any other breed. Of all the heavy breeds, the Percheron is the nearest to the blooded in shape and qualities. In addition to these qualities, he possesses a size and vigor that does not degenerate. To the people of the Southern States I would say, the Percheron would be especially desirable, your climate being so near that of their native France that no bad effects would result from acclimation, which is a frequent complaint in relation to the dull heavy breeds of Great Britain and Northern Continental Europe when they are transplanted to warmer climates.

To finish, I cannot too strongly urge upon the average farmer the necessity of breeding his mares to a good draft stallion if he would produce good, saleable colts; and it is my firm conviction that better results can be obtained from Percheron sires than any other. The produce will not only have size, bone and muscle, but what is just as essential, will preserve the style, spirit and action of the thoroughbred.

THE AGRICULTURAL CAPABILITIES OF WEST TENNESSEE.

BY HON. A. W. HAWKINS.

When Colonel Gates did me the honor to invite me to address this Convention, he designated a topic for such suggestions as I may be able to present.

The only objection which I have to the subject given me is based upon the magnitude of the task which is assigned to me.

Though the observations of a life-time, now exceeding three score years, coupled with years of special investigation, and of assiduous thought, have been devoted to the "Agricultural Capabilities of West Tennessee;" yet I confess, as I stand before you sir, charged with the presentation of this vast theme, I could wish that the duty had been assigned to some one abler and wiser than myself.

The territory before me has its delineations on two sides fixed by the Divine hand; on the east by the placid waters of the Tennessee River, and on the west by the mighty current of the majestic Mississippi. On the north we touch the "dark and bloody ground," while on the south we extend to the erstwhile land of "ash-cake," "cotton-bales," "mules," and "niggers."

The area embraced within these limits contains in round numbers six and a half millions of acres. In all these millions of acres, with their varying degrees of fertility, there is perhaps not a single one that can properly be classed as a desert; not one which may not be made to yield its quota to the sustenance and comfort of man, and very few the actual capabilities of which have ever yet been demonstrated.

In investigating the agricultural capabilities of a country no factor is of more primal importance than its climatic conditions. Lying between the parallels of 35° and 37° of North latitude, West Tennessee possesses a climate most genial and delightful for man, and at the same time adapted for the widest diversity of agricultural production.

Hence we find growing side by side the semi-tropical products of the South, with the cereals and other crops of more northern regions.

We are not, it is true, within the range of the "spicy breezes which blow soft o'er Ceylon's isle," but what is incomparably more valuable to us, we are within the influence of the Southern winds which, during the spring and summer months, come laden with moisture from the Gulf of Mexico, bringing fruitfulness in their train. Observations taken for a series of years of the

period from the last killing frost in spring to the first killing frost in fall gives us a growing period averaging about 200 days, while our annual rain-fall ranges from 45 to 52 inches, averaging about 47 inches.

This is distributed with wonderful regularity through the various seasons of the year. Without pretending absolute accuracy, the rain-fall for the various months averaging through a series of years may be roughly estimated as follows:

January, $4\frac{1}{2}$ inches; February, 5 inches; March, 5 inches; April, 5 inches; May, $3\frac{1}{2}$ inches; June, 4 inches; July, $4\frac{1}{2}$ inches; August, $3\frac{1}{2}$ inches; September, 3 inches; October, $2\frac{1}{2}$ inches; November, $3\frac{1}{2}$ inches; December, $3\frac{1}{2}$ inches.

From this general distribution of the rain-fall during the year it seldom happens that we have either disastrous floods or droughts.

Having then genial sunshine, a long growing season, and plentiful moisture, the next factor to be considered is the character of our soil as to fertility, and adaption to different agricultural products. Geologically considered, the formation of our West Tennessee soil is peculiar. Unlike Middle and East Tennessee, the soil of our section is not formed by the eruption and subsequent attrition of the solid rocks, but by the less violent process of deposition.

At some unknown period the old time sea, whose rocky shores may yet be traced along the vicinity of the Tennessee River, was by a process more or less gradual filled with deposits of sands, clays, and drift, brought from greater altitudes, and thus this goodly plateau was formed. In an agricultural point of view, this peculiar process of soil formation is one of interest.

Let us investigate this matter for a moment. Certain things are necessary to give fertility to soils. Certain elements enter into all vegetable growth. These are fourteen in number. Four of these are termed organic elements, and are derived from the atmosphere or from water, and are not found as permanent constituents of soils. These organic elements are carbon, oxygen, hydrogen, and nitrogen.

The other ten elements are termed inorganic, and are "of the earth earthy." They may be called "mineral elements" in contradistinction from the gaseous or organic elements, and must be present in the soil to render it productive. These mineral elements are potash, soda, magnesia, lime, phosphorus, silica, iron, chlorine, manganese, and sulphur. To be available as plant food these elements must be in certain chemical conditions and actually in solution.

To secure this available condition they must be exposed to light, heat, and moisture, and to the influence of the organic elements of plant food.

Now let us turn our attention a moment to facts which come under the observation of every farmer. Our virgin soil produces bountifully, forty, sixty, eighty bushels of corn to the acre. For a succession of years we cultivate the surface to the depth of from four to six inches. I can show you hundreds of fields in this country which have been in cultivation for fifty years, and that have never been stirred to a greater depth than four inches, while the farms are few indeed on which the plowing has exceeded six inches in depth. Our Northern brethren do better than this, but I am speaking of our West Tennessee agriculture. Now what is the result? After a few years of bountiful harvests the crops begin to fail, annually running lower and lower, until the once fertile field is given up to sassafras sprouts and broom-sedge.

Now I wish to turn your minds back to the statements which I made a few minutes ago, in regard to the peculiar geological formation of our soil. I do not mean simply our surface soil, but this solid earth on which we stand, even to the bottom of our old time sea. In the process of deposit by which this dry land was made to appear, the potash, the lime, and the silica were imbedded with every foot of earth that was builded up.

Dig down to the depth of ten feet, twenty feet, a hundred feet if you choose, take the earth from these depths, test it in the laboratory of the chemist and you will find it laden with the inorganic elements of plant growth.

Test it in Nature's laboratory. Mix it with decaying vegetable matter to give it friability, expose it to the action of the atmosphere, to the rains, and the frost, and to the blessed sunlight of heaven, and the same story will be told.

Now, let us go back to the sedge-field by which we passed a few minutes ago, and learn why it failed to respond to the labors of the husbandman. The reason is that the miserable four inches which was all that was ever opened "to the blessed airs of heaven," has been robbed year by year of its fertility, while in very truth each inch of soil beneath contains a mine of wealth.

According to the census of 1880, of the six and a half millions of acres in West Tennessee, only a little over two and a quarter millions were improved. Of the more than four millions of unimproved lands, it is safe to assume that three-fourths of it are susceptible of profitable cultivation, while of that already cultivated, I am sure I would not be going too far by saying that by industry and skill the product may be doubled, while by judicious management the soil would be improved every year.

I will not trespass upon your patience by attempting any calculating of the crops which the soil of West Tennessee might be made to yield. Suffice it to say that the miserable system of agriculture prevalent here is insufficient to give even a basis on which to estimate our capabilities for production.

You will, however, permit me to dwell briefly upon the wonderful adaptation of our soil and climate for a wide diversity of production. Here you will find the fleecy staple which claims to be king in commerce, the golden grain which gladdens the heart of the reaper, the rustling corn, the much condemned, yet much sought after tobacco, the luscious fruits of all temperate climes, with all manner of plants and herbs for food for man and beast; while on rich pastures and verdant meadows, lowing herds and bleating flocks riot for nine months in the year.

But to speak more in detail of our varied capabilities. Every county in West Tennessee can, and I presume does, grow cotton, and though the census of 1880 revealed the fact that Shelby was the second largest cotton growing county in the Union, I am glad that West Tennessee is not *par excellence* a cotton growing section.

Corn is grown everywhere profitably, though we may not claim to rival what is known as the great corn belt of the central West. Wheat has been grown here from the earliest settlement of the country, and while our harvests may not equal those of California, yet the experience of half a century demonstrates that labor and care bestowed in its culture are fairly remunerative.

The same general statement may be made with reference to the other cereals, oats, rye, and barley.

Tobacco from the northern counties of West Tennessee and fruits from the more southern and western counties are sought after in the great marts of trade. Potatoes, both Irish and sweet, are of excellent quality, and yield abundantly. But why enumerate, when in a single sentence I may say that every product of the temperate zones of the earth may be grown in West Tennessee.

The excellence which I would claim for this section consists not in its peculiar adaptation to any one agricultural product, but in the great diversity of production of which it is capable. I said a moment ago that I was glad that West Tennessee was not *par excellence* a cotton country. I will extend the same idea to wheat, to corn, and tobacco. The inevitable tendency where a single agricultural product monopolizes the soil is to concentrate wealth in the hands of the few, with the sequel of a large dependent class, doomed to be hewers of wood and drawers of water for the nabobs of the land.

• Diversity of production on the other hand tends to secure the independence of the laboring classes.

My idea of a prosperous agricultural country, and a happy and virtuous community, contemplates every man cultivating his own soil, by his industry raising the necessities of life for himself and family, with such surplus as he may be able to grow for the markets, and when fatigued with his labors, resting "under his own vine and fig tree."

One other feature and I will close. To develop and realize the agricultural capabilities of West Tennessee we must have diversity of pursuits.

All experience demonstrates that countries purely agricultural are universally poor. I may be asked why this is so when it is admitted that agriculture is the basis of all prosperity. I answer, it is for the want of a good market. Let us take a few figures to illustrate my meaning. In Tennessee, with about sixty-five per cent. of her population engaged in agriculture, the average value of the crop raised by each laborer of the farm is about \$150.

In Massachusetts with only about ten per cent. of her population engaged in agriculture the average value of each man's crop exceeds \$500.

Yet Tennessee has a richer soil and more genial clime, while her cotton, her tobacco, and her wheat, are in demand in all continents of the world. Do you still ask why the difference in the value of products per capita? I answer, each Massachusetts farmer has ten mouths to feed besides his own, with a market at his door for all his products, while the Tennessee farmer feeds but a fraction of another mouth, and pays freight, commission, and stealage, on his surplus products in their wild quest for a market to the distant shores of Europe.

To develop our agricultural capabilities then, we must have diversified pursuits. The hum of machinery should be heard along all our streams, in all our villages and towns. Every pound of cotton, or of tobacco, every bushel of wheat grown in West Tennessee, every pound of wool, should be put into its most valuable shape. This would give a home market, always the best market. The hundreds of thousands of operatives in the factories would be fed by the million of farmers required to till our millions of acres, and you might then realize the agricultural capabilities of West Tennessee.

ORCHARD-GRASS.

BY D. J. MILLS, ESQ., GALLATIN, SUMNER CO., TENN.

At the request of our Commissioner I have prepared a few notes on Orchard-grass.

I have been sowing this grass for fifteen years, and to give an idea about this valuable grass I will describe mine as it now stands: I have about three hundred acres which has been sown from two to fifteen years without reseeding, and it is now as green and luxuriant as can be (January 24th), notwithstanding the long spell of freezing weather that we have had this winter.

I think that it will grow and flourish in almost any latitude, judging from the way it stands the droughts and cold that we have here. I sow both fall and spring, and in almost every instance I get a good stand. I prefer, however, sowing in the fall, say from September 1st to the 20th. I sow one and one-half bushels of Orchard-grass seed per acre, and one bushel of clover to about fifteen acres, if I desire it for a hay crop the following year. I regard Orchard-grass and clover mixed, cut and sowed at the proper time, superior to any hay that I have raised on my farm, and I raise all kinds, Timothy, Herd's-grass, and all of the millet hays. I regard it as having the finest fattening qualities of any of the known grasses, and as for pasture or grazing grass, it is with me far superior to all others, blue-grass not excepted, as it is the earliest and latest grazing.

I have had much experience in grazing it, for instance last October one year ago I grazed 150 head of 1200-pound cattle, commencing October 1st and grazing them to January 10th.

I made a test of the fattening qualities of this grass, by weighing a lot of eight of those cattle after weighing them in Lebanon, Tenn., and driving them twenty miles to my farm. I then weighed the same lot of eight steers, in thirty days, after grazing them on this Orchard-grass, and they averaged a gain of forty-five pounds per head, although I drove them two and one-half miles to the scales. We thought that the entire lot averaged a gain of forty pounds per month per head up to the time we commenced feeding, which was the 7th day of January. Now, in fifteen days after taking the cattle off of pasture, I turned in 300 head of ewes, and grazed them until the 15th day of April, but I found that I had damaged my yield of seed by grazing the sheep so late in the spring.

Now understand, before beginning grazing the cattle in October, I had cut the grass for seed with reaper, self-binder, tied and shocked it as oats or wheat. It made a yield of ten bushels

seed per acre, which I sold to my neighbors and seed-dealers in Nashville at \$2.00 per bushel, and in ten days or two weeks after cutting for seed, I mowed the meadow, and made one ton of hay per acre, estimated in shed by measurement, which hay I sold to some parties I was grazing cattle for at \$8.00 per ton. This meadow was mixed with clover. I sold the straw after threshing the seed for \$5.00 per ton. Now in conclusion I will say that Orchard-grass stays green the year round, grows, too, when most needed, from the fall rains in September to maturity of seed. It is as much a winter grass as summer, and on good land, when not grazed too late in the spring, I am certain, from experience, that it will make from fifteen to twenty-five bushels seed per acre. All kinds of stock are fond of it. It grows from three to four feet high on my farm, when not grazed. It is perennial, and will last indefinitely. I have been grazing since November 1st 100 head of 1200-pound steers; took them off of pasture 10th January last; I have sheep now on same pasture, but will not pasture them so late as I did last season.

For the last two years I have threshed my seed with an ordinary ground-hog thresher, as I find it does not waste the seed so much as the steam separator. A great many of the seeds are blown out with the steam in a separator. I use an ordinary wheat-fan for clearing the seed by shutting off the wind. I have never sold any seed for less than \$1.85 per bushel, wholesale price. I will say that I regard the straw, after threshing the seed, of more value than German millet or Hungarian hay. In fact, I take as good care of the straw as I do of any hay.

The following statement will show the value of fifty acres of Orchard-grass, which is taken from my books, carefully noting every detail and expense:

Cut for seed 10th of June; average, 10 bushels seed per acre; 500 bushels, at \$2 per bushel, \$1,000.

June 25th, mowed for hay; average, 1 ton per acre; sold at \$8 per ton, \$400.

This was excellent hay, being mixed equally with clover, and sold below the market price to Kentucky feeders on the farm.

The straw, after the seed was threshed, was sold to same feeders, at \$150.

Grazed 150 head, 1,200-pound steers from October 1st to January 10th (3 months) at \$1.50 per month, \$675.

Cattle removed January 10th and 300 ewes put on the 50 acres and grazed until April 15th, 3 months, worth 20 cents a month per head, \$180. Total receipts, \$2,405.

This should be charged by the 150 cattle grazing on adjoining fields one-half, \$340.

Sheep on adjoining fields, \$90.

Expenses cutting and shocking for seed, \$1.25 per acre, \$75. Threshing, fanning, and hauling, 20 cents per bushel, \$200. Mowing and delivering the hay in sheds, at \$1 per acre, \$50. Interest and tax on land, \$187.50.

Total receipts, \$1,462.50. Average, \$29.25 net per acre. It will be remembered that this land was seeded some seven years before, and there has been no expense of reseeding or manuring since, as the droppings from the cattle while grazing will keep up the fertility of the soil, and I have never found it necessary to make an application of any commercial fertilizer. I think it would be a great advantage, and very necessary to use a fertilizer where you do not pasture the land.

THE HOLSTEIN-FRIESIAN COW.

ADDRESS BY A. V. GOODPASTURE, CLARKSVILLE, TENN.

There is a widespread, and, as I believe, a well-grounded demand in this country for a "general purpose" cow—one that will unite with the best dairy qualities superior excellence for the production of beef. This demand is evidenced by the marked favor with which the Holstein-Friesian has been received, and her unprecedented increase and distribution, no less than by the evident and decided tendency among the owners of Shorthorns, Devons, and some other breeds, to develop in them "general purpose" families. Whether this demand was created by the advent of the Holstein-Friesian to the United States, or whether the recognized demand caused her introduction, I cannot say, but those whose experience has reached her are singularly unanimous in the conclusion that she fully meets it.

The Holstein-Friesian is essentially and eminently a dairy cow. Every "general purpose" cow is necessarily a dairy cow, and conversely, the ideal dairy cow is necessarily a "general purpose" cow. Between two cows giving equal amounts of milk and its products, she is the better that excels in beef. The Jersey is a noble little cow, and I confess to great admiration for her, but the Jersey steer, and the grade Jersey steer, and the dry Jersey cow, are an absolute curse to our farmers and our beef market. The farmer and dairyman need more beef. While this is so, beef is but an incident to the "general purpose" cow. I would no more think of banishing her to the Western ranch than I would think of consigning the trotting-bred horse to the Southern cotton field. The trotter might take the place of the mule very well, but he is too valuable for the carriage or the turf to be extinguished in that way. Beef is but an incident, but the farmer or dairyman cannot afford to despise or neglect it. There are too many bull calves and dry cows. If these are of such size and quality that they can be profitably converted into beef, then you have an ideal farm and dairy cow. Let me give you an illustration: The grandest cow I ever read of was the Holstein-Friesian, Lady Clifden (159). During four consecutive years of her useful life a record of her performance was kept, which shows an aggregate yield of 58,031 pounds of milk, being an average annual yield of 14,507 pounds 12 ounces, and when, at the age of fifteen years, she ceased to breed, without extra feeding to fatten her, she dressed 1,212 pounds of beef,

pronounced by competent judges equal to any on the market, and was sold to the butcher for \$120.

As a milk producer, the Holstein-Friesian is not only without an equal, but she is unapproached by any other breed. Her superiority is not more marked in the amount of her daily yield, than in the persistence with which she maintains it from calf to calf. Yearly records of from 12,000 to 15,000 lbs. of milk are not uncommon, and they sometimes reach from 20,000 to 23,000 lbs.

Here is a list of twenty-eight cows that have given from 16,009½ lbs. to 13,775½ lbs. in 365 days or less.

Holstein-Friesian Milk Records for One Year.

NAME.	No.	TESTER.	LBS.	Oz.
Echo -----	121	F. C. Stevens -----	23,775	8
Princess of Wayne -----	954	T. G. Yeomans & Sons -----	20,469	9
Lady Fay -----	4470	Smiths, Powell & Lamb -----	20,412	12
Aaggie Rosa -----	2605	Smiths, Powell & Lamb -----	20,225	3
Empress -----	539	Gerrit S. Miller -----	19,714	4
Jamaica -----	1336	John Mitchell -----	19,547	---
Netherland Belle -----	1876	Smiths, Powell & Lamb -----	19,516	8
Payne's Lady DeVries -----	5895	H. L. Payne -----	18,848	8
Violet -----	743	Edgar Hindekoger -----	18,677	3
Aaggie 2d (10 months) -----	1360	T. G. Yeomans & Sons -----	18,300	13
Ethelka -----	1208	John Mitchell -----	18,131	7
Aaggie -----	901	Smiths & Powell -----	18,004	15
Clothilde -----	1308	Smiths, Powell & Lamb -----	17,970	14
Aaggie Cornelia 3d -----	4342	Smiths, Powell & Lamb -----	17,350	---
Lily -----	1964	T. G. Yeomans & Sons -----	17,302	14
Netherland Dowager -----	2632	Smiths, Powell & Lamb -----	17,160	11
Aaggie Sarah -----	4412	Smiths, Powell & Lamb -----	16,933	13
Egis -----	69	Smiths & Powell -----	16,823	10
Netherland Princess -----	862	Smiths, Powell & Lamb -----	16,766	13
Aaggie Constance -----	2628	Smiths, Powell & Lamb -----	16,761	11
Minx -----	402	Carey R. Smith -----	16,628	8
Netherland Duchess -----	2498	Smiths, Powell & Lamb -----	16,520	7
Mollie Bawn -----	---	C. W. Horr -----	16,391	6
Lady Clifden -----	159	Wm. A. Russell -----	16,274	---
Aaggie Hannah -----	4361	Smiths, Powell & Lamb -----	16,268	6
Maid Marion -----	181	Wm. A. Russell -----	16,137	---
Frieda -----	306	John Mitchell -----	16,076	---
Valley Beauty -----	4562	Smiths, Powell & Lamb -----	16,009	8

We sometimes see it intimated that these records are produced by a system of unnatural forcing, which the cow cannot long survive. Undoubtedly they must have consumed much to have yielded such enormous results. And it is a noble tribute to the strength of their constitutions, and the power of their digestive organs, that these all survived. I believe only two of

them are yet dead, one of which was slaughtered at fifteen years of age, and the other died after giving birth to triplets at the age of eleven or twelve. Not only have they survived, but many of them have continued their record from year to year, as will be seen from the following list of cows, whose records have been kept for more than one year :

Holstein-Friesian Milk Records for More Than One Year.

NAME.	No.	No. of Years Test'd	Aggregate Yield.		Av. Yield per Y'r.	
			Lbs.	Oz.	Lbs.	Oz.
Maid Marion-----	181	7	87,379	----	12,482	11
Ægis-----	69	5	67,938	7	13,587	10
Crown Princess-----	6	6	61,112	----	10,185	5
Aegis 2nd-----	235	5	60,752	6	12,150	7
Lady Clifden-----	159	4	58,031	----	14,507	12
Violet-----	743	4	57,342	4	14,335	8
Dowager-----	7	6	53,805	8	8,967	9
Netherland Princess-----	862	3	43,607	12	14,535	10
Fraulein-----	9	6	42,371	8	7,061	14
Echo-----	121	2	41,896	----	20,948	----
Sylph-----	762	4	40,608	----	10,152	----
Janeka-----	-----	4	40,368	----	10,092	----
Netherland Duchess-----	2498	3	40,122	7	13,374	2
Juffron-----	-----	3	35,040	----	11,680	----
Netherland Belle-----	1867	2	33,165	14	16,582	15
Frieda-----	306	2	30,261	----	15,130	14
Agate-----	236	2	22,161	----	11,080	8

This table I regard as exceedingly valuable. It is not likely any cow would survive a system of unnatural stimulation for a period of four, five, six, or seven years. I think you may take these records as showing the "business" capacity of the respective cows, under such good care and treatment as they deserve, and as any successful breeder might give them. But most of the individuals tested are above the average of the breed.

Perhaps you would get a better idea of the average capacity of the breed to take the record of a whole herd. I will take for the purpose of illustration, the herds of T. G. Yeomans & Sons and John Mitchell. In 1882 Yeomans & Sons tested seventeen cows, two eight years old, one three years, and fourteen two years, and they gave them 198,495 lbs. 12 oz., an average of 11,676 lbs. John Mitchell makes a business of selling bottled milk to the city of Brooklyn. After testing various other breeds, and more especially the Ayrshire, among which he was raised, in their native country, he has collected him a herd of Holstein-Friesians. Of this herd he says:

"Twenty-six records completed last season (my entire herd) show an average of 9,746 lbs.; average age at calving three years and seven months; average days in milk 348. This season I have thirty-four in milk, and the records will, I think, be improved on. My cattle receive what is called "ordinary good care," no forcing attempted. I am therefore safe in claiming that a herd of well selected *matured* Holstein-Friesians, with decent treatment will average 5,000 qts. of milk per annum, and raise their calves as well."

This is a wonderful showing, but it represents, in my opinion, about what you might expect if you should go to work to collect a "business" herd of Holstein-Friesians.

Those who have had no experience with Holstein-Friesians' milk are apt to suppose its quality poor, for no better reason than the large quantity given. They could not fall into greater error. It may not be as rich in butter as that of Landseer's Fancy, but the quality of milk is determined by the amount of *total solids*, in which none can exceed the Holstein-Friesian. Here are some experiments made by Prof. H. W. Smith, of Cornell University, chemist for Houghton Farm Experiment Station, which I submit with his comments on them. In 1884 he visited "Meadowbrook," the home of Mr. John Mitchell, in company with Maj. H. E. Alvord, of Jersey fame, witnessed the milkings and took his samples. He says:

"Below I give the total number of pounds which each cow gave per day of each constituent, and I think the result remarkable. The largest yields of total solids I have ever seen :

	POUNDS OF PER DAY.		
	TOTAL SOLIDS	FAT.	CASINE.
Matron -----	6.2	1.66	1.55
Oriana -----	6.4	1.96	1.2
Soziana -----	5.19	1.48	1.18
Anthem -----	4.78	1.29	1.34
Ethelka -----	5.12	1.6	1.2
Jamaica -----	5.16	1.43	1.43

"And this is the true test of a cow—not how rich her milk, but how much of each constituent does she give. Certainly you may be proud of your Holsteins."

But perhaps the test most satisfactory in the matter of milk, as in most other matters, is the money test. I shall not particularize, but I am assured by many who sell, that Holstein-

Friesian milk brings the highest market price, both at the factory and in the city.

I have been speaking of milk as milk. If there be any here who doubt the capacity of the Holstein-Friesian as a butter cow, I invite his attention to what shall immediately follow. The Holstein-Friesian, though the oldest breed of cattle in the world, is comparatively new to this country, and little thought was given to her butter capacity, until public attention was challenged to it by a remarkable event. I refer to the celebrated contest for the *Breeders' Gazette* Silver Cup, in 1882-83. I give the result as it was announced by the committee, consisting of the President and two ex-Presidents of the Illinois State Board of Agriculture:

"The undersigned, to whom was referred the matter of awarding the silver cup offered by the *Breeder's Gazette* to the owner of the cow that shall produce the largest yield of butter, for thirty consecutive days, between the 1st of July, 1882 and the 1st of July, 1883, beg leave to report that the following entries have been made for the premium: Valancey E. Fuller, of Hamilton, Ont., enters the Jersey cow Mary Ann of St. Lamberts 9770; Thomas B. Wales, Jr., of Iowa City, Iowa, enters the Holstein cow Mercedes 723.

"The detailed statements of the competitors, verified by affidavits, are appended and marked as follows: Valancey E. Fuller, A; Thomas B. Wales, Jr., B.

"The affidavits show the yield of unsalted butter made from the milk of the competing animals, during the test of thirty days, to be as follows: Mercedes 723, 99 pounds 6½ ounces; Mary Ann of St. Lamberts 9770, 97 pounds 8½ ounces; in favor of Mercedes, 1 pound 14 ounces.

"The silver cup is awarded to Thomas B. Wales, Jr., of Iowa City, Iowa, the owner of the Holstein cow Mercedes 723, her record being 1 pound 14 ounces better than that of Mary Ann of St. Lamberts 9770."

Mary Ann of St. Lamberts was then recognized as the greatest living Jersey cow, and the fact that she should have been defeated in this contest by a Holstein-Friesian, made the public begin to inquire, are not these Holstein-Friesians good butter cows? And the breeders of Holstein-Friesians, many of whom were no less surprised than the public, began at once to test their cows for butter, and they have been rewarded with astounding results. Here are the seven days performance of some of them:

Holstein-Friesian Butter Records for Seven Days.

NAME.	No.	TESTER	LBS.	Oz.
Aaggie 2d	1360	G. T. Yeomans & Sons	26	7
Mercedes	723	Thos. B. Wales, Jr.	24	6
Ægis 2d	235	Smiths, Powell & Lamb	23	7
Neiltje Korndyke (M. R. O. F. H. B.)	9	Burrell & Whitman	23	2
Princess of Wayne	954	G. T. Yeomans & Sons	22	9
Oatka	945	G. T. Yeomans & Sons	22	8½
Georgie	944	G. T. Yeomans & Sons	21	15½
Sadie Vale	958	G. T. Yeomans & Sons	21	10
Overlooper	1626	Thos. B. Wales, Jr.	21	10
Lily	964	G. T. Yeomans & Sons	21	4½
Lady Netherland	1263	Smiths, Powell & Lamb	21	3
Mink	402	Carey R. Smith	20	9
Prairie Flower	962	G. T. Yeomans & Sons	20	1
Tietje 2d	726	.....	20	.....
Amelander	6523	Thos. B. Wales, Jr.	20	.....
Netherland Queen	414	Smiths, Powell & Lamb	20	.....

Let me add that Aaggie 2nd (1360), that gave 26 pounds 7 ounces in a week, also gave 105 pounds 10½ ounces in 30 days, and 304 pounds 5½ ounces in 90 days, the latter being the largest 90-day yield yet reported for any cow of any breed.

These are individuals selected out of several different herds, but I now give you the result in a single herd, that of T. G. Yeomans & Sons, Walworth, N. Y.:

5 cows have averaged per week.....	23 lbs.	7 oz.
10 cows have averaged per week.....	21 lbs.	14 oz.
15 cows have averaged per week.....	20 lbs.	12½ oz.
17 cows (4 years and over) per week.....	20 lbs.	1 oz.
5 cows (3 years) per week.....	17 lbs.	1 oz.
5 cows (2 years) per week.....	14 lbs.	3½ oz.

Thirty-eight cows and heifers (17 being 2 years old) have averaged 1 pound of butter to 21 $\frac{3}{5}$ pounds of milk. This from a herd of less than 40 cows in milk.

The manufacturers of Holstein-Friesian butter claim for it superiority over all others in some respects, especially in its keeping quality. But however well founded this claim may be, it is a fact that it usually sells for the highest market price. Indeed, whenever it has come in competition with the product of the Jersey and other butter breeds, at our leading fairs, it has always come off with credit, and not unfrequently with the highest honors.

In 1881, and again in 1883, Holstein-Friesian butter received first prize at the Ononadaga County Fair, at Syracuse, N. Y.

At the Tri-State Fair, for the States of Ohio, Indiana, and Michigan, held at Toledo, Ohio, in 1882, the Holstein-Friesian product was awarded first prize, both for dairy and factory butter.

In 1884, Holstein-Friesian butter received first prize at the Ontario County (N. Y.) Fair, and at the Iowa State Fair.

Again, at the Chicago Fat Stock and Dairy Show, in 1885, Holstein-Friesian butter took first prize for best package of butter of not less than 50 lbs., over sixty-five competitors.

Special premium offered by the DeLavae Cream Separator Co., for best tub of butter of not less than 50 lbs., over thirty-eight competitors.

First prize for best package butter made in New York State.

And second prize on best five prints of butter of 1 lb. each.

But whatever may be the ultimate verdict upon the Holstein-Friesian as a butter cow, there can be no question of her supremacy as a producer of cheese. The only criticism of her in this respect, I have met with, is from the pen of Mr. Valancey E. Fuller, the owner of Mary Ann of St. Lamberts. He has recently furnished a number of articles to the press, in which he seeks to show, from a single series of experiments, that the milk of the Jersey cow is richer in casine than that of the Holstein-Friesian. These experiments show that the Holstein-Friesian gave 7,000 lbs. of milk in a year, and made 10.9 lbs. of cheese curd per 100 lbs. of milk, while the Jersey gave 3,500 lbs. of milk, and made 15.6 lbs. of cheese curd per 100 lbs. of milk. The "Chemical Analysis of Milk," in the same series of experiments, show 8.15 lbs. of solids other than fat per 100 lbs. of Holstein-Friesian milk, and 8.03 per 100 lbs. of Jersey milk.

These results do not correspond with those obtained by dairy-men on this side of the "River," but take them as not only correct, but as representing the performance of the respective breeds, and it is a mere matter of calculation to see that in one year the Holstein-Friesian would make 763 pounds of cheese curd against 546 pounds for the Jersey, a difference of 217 pounds, or nearly 40 per cent. in favor of the Holstein-Friesian, while the amount of solids, other than fat, would be 507.5 pounds against 281.05 pounds, a difference of 226.45 pounds, or about 80 per cent. in favor of the Holstein-Friesian.

Mr. Fuller saw this, and throws some discredit upon the experiments by the statement that "the quantity of milk is *estimated*, and so far as it relates to the Jerseys, is according to my experience, and that of others, at least 1,000 pounds too little." He adds: "The average for the year 1884, of the Oaklands herd, including heifers, was 6,382 pounds of milk for all that remained upon the Oaklands for a full year; this by actual daily weighing."

The "Oaklands" is confessedly one of the finest herds of Jerseys in America, and I have no doubt it can show as large yearly averages as any other. Now let us compare the yearly averages of the "Oaklands" Jerseys with those of the "Lakeside" Holstein-Friesians. In 1885 twenty cows, four years old and over, and twenty-four, two years old, completed their yearly records at "Lakeside," and although they contained nearly 55 per cent. of two-year-old heifers, they averaged 12,962 pounds 8 ounces.

The relative yields in the tests of the Ontario experiment station was two to one in favor of the Holstein-Friesian. The ratio between Smiths, Powell & Lamb's Holstein-Friesians and Mr. Valancey E. Fuller's Jerseys is a little more than two to one in favor of the former.

I will only add that the rural inhabitants of Holland, though their country is second only to Belgium in density of population, have for some thousands of years not only maintained themselves but have done it so well that they are surrounded with more comforts than those of possibly any other country in the world. The source of their wealth has been the Holstein-Friesian cow, and her chief product has been cheese. Holland cheese is celebrated the world over, and justly so. This, to me, is a more profound argument in favor of the capacity of the Holstein-Friesian for the production of cheese than the test of any individual or herd, though it be made on an experimental farm, which you will permit me to say—while useful, so far as my observation extends—is far less reliable than the actual results of a "business" herd, kept for the dairy or factory.

But the perfect dairy cow will not only produce milk, butter, and cheese, but she will be adapted to the profitable production of beef. And why is it desirable that a dairy cow should possess beef qualities? Aside from the fact that the large cow is the most economical milker, which not only commends itself to reason, but seems to have the sanction of experience, every dairy cow will have calves, and unfortunately a large number of these will be bulls. Now what are you going to do with your bull calves? The dairyman will possibly sell some of them to the butcher for veal. If so, the Holstein-Friesian will make the finest veal in the world. The calves not unfrequently weigh 100 lbs. at birth, and gain 100 lbs. per month till 5 months old, and Jaap IV. weighed 1,200 lbs. at 11 months old, making a gain of $5\frac{1}{2}$ lbs. per day for thirty days. But the farmer will likely desire to mature his bull calves for beef. If we may judge by the grades whose sales are reported, he will have in the Holstein-Friesian, an animal hardly less profitable than the Shorthorn or Hereford. There have been but few

thorough-breds slaughtered in this country. Geo. E. Brown & Co. caused a four-year-old heifer to be slaughtered, and Edwards Bros., Ottawa, Ill., the butchers, say of her:

"Full-blood, mature Holsteins are yet seldom to be had in this vicinity to kill. Our first opportunity occurred last week in the form of a four-year-old heifer from the herd of George E. Brown & Co. We paid six cents per pound for her, weighed from the barn. She weighed 1,705 pounds and dressed 1,036 pounds, and had 161 pounds of rough tallow. She was very thick on the rib, the fat evenly distributed, and the meat well marbled.

"We use in our trade the best Shorthorn and Hereford steers we can buy, and this heifer was fully equal to any we have cut. We took particular pains to learn from some of our best customers how the meat proved on the table, and all were highly pleased."

In 1884-85 Smiths, Powell & Lamb caused the two-year-old bull Syracuse (822) and the four-year-old heifers Signet (187) and Little Wonder (1788) to be slaughtered. Syracuse weighed 2,290 pounds and dressed 1,430 pounds, making 62.44 per cent. of dressed beef and 26 per cent. of offal. Signet weighed 1,470 pounds and dressed 915 pounds—per cent. of dressed beef, 62.31; offal, 24. Little Wonder weighed 1,493 pounds and dressed 791 pounds—per cent. of dressed beef, 52.93; offal, 33.

The butchers who bought the carcasses of Signet and Little Wonder say:

"We are much pleased with the two Holstein heifers purchased of you last month. We have been in the meat business for the last twenty-five years, and have killed all grades of cattle—the best we could find in the country—but never have we had any that would equal in quality those purchased of you. We have had a great many compliments from the leading families in the city, in regard to the Holstein beef."

With these examples and testimonials I close my discussion of the "business" qualities of the Holstein-Friesian, and will add but a word from an esthetical standpoint. She is certainly one of the most beautiful and attractive cows in the world. She is so quiet and docile in disposition that you are tempted to approach and stroke the soft, velvety coat, and feel the rich, mellow skin, and when you see the mild, though bright and intelligent eye, as the head is turned to receive a caress, she wins your confidence at once. But a herd of them, as they graze upon the fresh, green field, with their large, symmetrical, and handsome forms, their perfect uniformity of type, and their coats of ever clear and distinct black and white, combined in the most picturesque proportions, it is a scene that would adorn any landscape in the country.

CENSUS IS KING.

ADDRESS OF HON. W. M. BURWELL, NEW ORLEANS, LA.

MR. PRESIDENT AND MEMBERS OF THE AGRICULTURAL AND INDUSTRIAL CONVENTION: In order to constitute an independent and prosperous State we should organize three principal departments of popular industry—agriculture, commerce, and manufactures.

The principal scope of your Convention lies in the development of the agricultural productions of the planting States of the South. This interest could be confided to no more faithful or competent hands.

You have well considered the science of farming, for a plant, like an animal, must be fed, and will as soon deteriorate from the absence of an aliment essential to its perfect development. The great value of high or scientific farming, however, is this: A local climate surely favorable to the perfect production of a staple, it may be wine, or wool, tobacco, or cotton. It is comparatively easy to adjust the chemical components of the plant. It is impossible to create the climatic components adapted to its growth. By scientific farming, therefore, the production of a staple is perpetuated, amid social and political conditions, as essential to the happiness of the community as the profitable growth of the staple itself. No high standard of manhood and womanhood can be maintained where the land has lost its capacity to subside the higher class of mental and moral refinement. Planting the great Southern staples of tobacco and cotton has, however, resulted in the rapid exhaustion of the chemical elements indispensable to the perfection of these staples, and the planter has deemed it wiser to exhaust these evanescent elements, and seek them by removal to new lands, than to create them anew by fertilizers, by compost, or by grasses. This he leaves to the farmer who succeeds him.

Your Convention, therefore, gentlemen, sits as a syndicate to consider how this vast territory, denuded of its forests and fertility, depopulated of its labor, shall be restored to usefulness. Nature timidly follows the departing footsteps of the planter-emigrant to Texas or Nebraska with an indigenous growth of pine and broomstraw, which conceals the ravages of the one system of agriculture and prepares it for the care and culture of another. In the performance of your duties you have perhaps censured the planter because he has not also been a farmer and a stock raiser. Upon this question I cannot enter farther than to say that I consider the Southern planter the

most judicious, energetic and successful class of industrials in the country or in the world, and refer to the cotton crop to prove his success. But you propose to mix your agricultural industries. This has been necessarily done by Southern farmers; grain growing, stock raising, and truck farming are subdivisions of agriculture which may be profitably adopted. I propose that you shall carry this system of combination and co-operation a step farther. I propose that you adopt a system of

MIXED INDUSTRIES

in which the planter and farmer shall unite with the manufacturer and the commercial carrier for the primary advantage of the agricultural, and the recipient's interest of the other kindred pursuits.

The planting States of the South are credited in the National estimates with reputed values of cotton amounting in 1884 to \$197,015,206. They also produced a large value in sugar, rice, and tobacco.

These values are to a great extent paid for in Western provisions, with animals, and in commodities consumed in their use, so that the planting States have really very little left to carry to capital account. We even find that a larger proportion of the cotton money is charged against these commodities than formerly, because the wants of the colored population are greater than when in their former condition, and their earnings are expended to a large extent in goods of a more costly description.

In like manner the Southern planter pays freights to Northern railways and shipping, and employs foreign roads to carry the crop to market; nor does he even advance his raw material to the first stage of manufacture before committing it to other hands. These hands realize more profit upon the material than the planter has done by its production.

We have examples of the economy effected by great nations in organizing this complementary system of industries. England derives food and raw material from abroad, and imparts to their combination such value by her capital and skill as to have attained great prosperity. Belgium, perhaps, displays the most perfect consummation of a well-balanced system of reciprocal industries. She has immense capital and high credit, a system of agriculture which utilizes every inch of arable surface and employs every scientific agency for the production of animal food. She has shipping upon every sea, with canal and railroad transportation to every farm. As she has coal and iron ore of the best quality, her mountains timber land, her most perfect, and her cheapest fabrics are metals and textiles. She has illustrated the fine arts by works of skill and genius,

which command the admiration of the civilized world. Do you ask if she is free? if her people are moral and religious? History shows that, to defeat moral and religious despotism, she sacrificed millions of lives and incomputable millions of property. Upon an area of 11,000 square miles—not larger than two or three American counties—Belgium, through the perfection of the compensatory and reciprocal industries, supports a population of nearly six millions. Upon an area of about five per cent. that of Alabama, Arkansas, Georgia, and Mississippi she supports a population equal to that of these four States. This population of more than 400 to the square mile is subsisted chiefly upon those industries which the four Southern States have not yet developed. This summary would be incomplete if it is not remembered that this little tract, now so fertile and so active with enterprise, has been wrested and defended from the North Sea by dykes; that it has been drained by canals, and that lakes and lagoons have been pumped out and kept free from water, so that the beds of these lakes have been added to the arable area of the State.

This example of a properly balanced system of industries with their attendant power and intelligence, has been given with the special intent to prove that these industries, manufactories, and commerce are not demoralizing in their tendencies, and that they do not nurture a timid and venal population, incapable of appreciating or defending their liberties.

WHY WE HAVE NOT ENCOURAGED MANUFACTURES.

There are some reasons why the planting States have not encouraged the development of these industries. The dominant school of Statesmen from the formation of the Union were vigilant guardians of the sovereignty of the individual States. The recognition of this statehood was embodied in the acknowledgment of American independence. There was also a hostility against all extravagant appropriations, against all corporate enterprises, and all bonded debt. The National Government was a suspected trustee, and the Southern statesmen would neither accord to others, nor accept for themselves, any indirect aid from the common credit or other American power. These statesmen manifested a Spartan simplicity in their habits of private and public life. No men could have been more virtuous, patriotic, or self-denying. It was believed by them that slave industry fitted the upper classes by thought, education, and action, for the conduct of political affairs, as it rendered them invaluable in the field. Cotton was a monarch, in whose presence the sheared industries must prostrate themselves. Essays were not inviting in which it was assented that precious metals should be the Southern currency, and it was alleged

that the mechanical industries could not be introduced without injury to the social stamina of the Southern States. The Southern doctrine was announced in debate, that all indirect taxation was unjust, the duty on imports, if employed, should be limited to the production of revenue, and even that then duties should discriminate against productions in order that every industry should stand on a perfectly equal footing.

The imposition of duties for the protection of manufactures, the construction of roads to promote commerce between the States, the creation of a bank entrusted with the credit of his government were advocated as necessary to the public defense and general welfare by statesmen of the North.

At every election was therefore arrayed a delegation of able and resolute men pledged to defeat any plan of National manufactures or improvements. It could not have been suspected that domestic enterprises or distant capital could have opened our mines of coal or iron, assembled industrial populations amid our enterprises or built ways for the transportation of immigrants from other quarters. Hence while the North, which needed individual development, built ships, work-shops and roads, brought in immigrants and homesteaded them upon lands acquired by Southern valor, donated to the Union by Southern generosity, the South repelled all these agencies and preferred to rely exclusively upon her own native and unaided resources. The pages of our history are filled with the heroic resistance of the South to the appropriations which have built up other sections and given them practical supremacy in the material interests and political action of the Union. It is there that other sections contributed the currency and credit of the Government, the navy and commercial marines, the home and foreign press. It pre-occupied the common domain by transporting Southern staples abroad and bringing back in the steerage thousands who were speedily transmitted into representatives and sovereign States, and later into armies.

FROM A COLONY TO A NATION.

We are constrained to see and to say that the Government has undergone changes according to the ascendancy of the constituency by which it is administered. The immense infusion of foreign sentiment must have modified the doctrines of the revolutionary statesmen. Allowing the normal increment of the colonial population, and deducting it from the total, the gross population of the Union, and there is but one person in every four descended from revolutionary ancestry. The sway of a numerical majority is gradually being felt over the limitations embodied in the Federal Constitution, and intended to protect minorities, or the autonomy of the separate States.

The war established by capitulation and constitutional acceptance, the power of the National Government to construe the Constitution and enforce the laws of Congress and the decrees of the Supreme Court.

The Electoral College is based on numbers. The power to appropriate money and regulate revenue is apportioned according to a ratio of the National Census. New States are formed by a given ratio of people inhabiting a parallelogram of the public domain. The American Senate is watered by the admission of new and numerous States. Wealth and industry accompanies this immense aggregation of numbers, and the poorer and less populous States of the Union, as the principalities and provinces of Europe, are tending to concentration and organization. To this the system of currency, revenue, the post, the press, the telegraph, internal transportation, and travel contribute. Yet, there are those philosophers who insist upon the doctrine of limited and defined powers, and denounce the measures enacted under the "general welfare" clause as illegal. It must not be forgotten that the Constitution did not recognize slavery, nor do we believe that institution was ever established by statute in any State. It was entitled to protection by implication. The logical deductions of a power from an obligation has been employed by some to justify the protection of manufactures, the construction of works, the erection of levees, the appropriation of rations for the starving, the education of the ignorant. Nothing of this is written in the Constitution. Those who condemn the conclusions of this logic denounce all such restrictive legislation as robbery.

Can it be possible that a majority of the American people will "rob" the minority? Those who hold the people in such suspicion cannot believe in a republican representative government. They must at heart prefer the purer government of a monarchy, an aristocracy, or a hierarchy. Right or wrong, the present constituency have changed the restricted for the liberal construction. Sherman did not reach the sea under the Constitution; Virginia was not dismembered according to the terms of the compact. President Lincoln found no warrant for proclaiming the freedom of the slaves unless their masters should return to his allegiance before a given day. The tax on cotton was in no sense legal. It may be said that these powers were only secured in war—we may suppose under the authority to provide for the common defense. Our own Confederate Constitution was violated in like manner by the conscription act, the seizure of private property, and the invasion of the sacred rights of the States. Is the Constitution then a written code for peace and an unwritten code for war? Was the war fought for the preservation of the Constitution? On our side we fought for the abro-

gation of that instrument, and the substitution of a new compact among the States. The reconstruction of the Union was the will of the conquerors, and not the consent of the governed. We had capitulated, and amended the Constitution to comply with prescribed conditions. The Supreme Court is established as the permanent arbitrator of differences between the National and State Governments, and we see every day obedience yielded to its decrees. We find a system of National banking accepted without resistance. All disputed doctrines have been adjusted. Can we expect the conquerors to go back and reinstate the *statu quo ante bellum*? We must take the law as it has been dictated to us—with the right, of course, to change it according to the terms prescribed by the Constitution.

It is difficult to answer how any one who went through the war, as a soldier or a private citizen, can expect the conqueror to raise us from the ground, restore our sword, and calmly proceed to re-instate exactly the construction of things which had existed before the first gun of Sumter.

The people, the source of power; the Colonies, the Confederacy; the Union, the Nation; all grade up to the sovereignty of the Nation with the indestructible constancy of the States. The people are, in the immortal words of Sidney, "the source of all power;" in the words of Thomas Jefferson they are "born equal" in all political right. The war among the States was a revolution through which the people have attained the summit of all power they enact, interpret, execute. What other power is there that can resist their decree or wrest the scepter from her mailed hand of her people?

As population is the sole basis of power under our representative system, and this power is attracted by the inducements congenial institutions and varied employments, every State must present these inducements to attract or retain numbers, and so to acquire political weight in the common government. We need not tabulate the original and relative weight of the several States in the Union. Virginia was, in 1790, the first State; to-day she is the fourteenth. South Carolina was the seventh; she stands now No. 21. North Carolina was No. 3; to-day she is No. 15. On the other hand, those States which have increased their population through the mixed industries, have either maintained or advanced their positions. New York, the fifth in 1790, is now the first; Pennsylvania, then the second, is still the second. Ohio and Illinois, a wilderness in 1790, and counties in the State of Virginia, now rank as the third and fourth States in the Union. They demonstrate the power of numbers. The Southern States, which once held a position approaching supremacy, or at least the hegemony of the Union, have declined relatively to a subordinate influence

in filling the chief official appointments and impressing the policy of the government. These Southern States have now but 38.50 per cent. of the Senate, and 31.80 per cent. of the House of Representatives.

The differences in industrial policy between the planting and the other States of the Union culminated in the acquisition of power on the part of the other States. They had preoccupied the national domain, erected new States, and this, with the importation of immigrants, controlled the policy of the Government, and so amended the Constitution as to impress upon it the will of the majority of people and States.

When the South deemed it necessary to avoid the danger apprehended from this possible perversion of the original intent of the framers of the Constitution, this industrial system of the North was found formidable, in a military sense. The credit of the National Government was usurped to emit bonds and currency, and the money thus created was expended in the purchase of war material and the pay of soldiers. No army was ever so well fed, armed, equipped, and transported. No people were ever made more comfortable by the liberality of their wages and the abundance of their supplies. The justice and gallantry of the Southern States, unsupported by equivalent revenues, were unable to maintain such a war or compete with such an opponent, for while these opposite doctrines prevented the strategy of invasion and inaction, the South was a portion deemed impregnable, the North developed every capacity and employed every agency of industrial warfare. The dream that no fortress can withstand the force which may be generated for its reduction received confirmation in this conflict of systems.

The result of the war has been that of a lawsuit in which the subject of controversy has perished in the course of litigation. The only peculiar institution which has separated one section from another has passed away, and we need not now post pickets where there is no enemy. There can be no reason to continue a policy of exclusiveness which has proven itself inadequate in the past and which can but perpetuate and intensify our dependency in the future.

ADOPT THE MIXED INDUSTRIES.

We must change our system of exclusive agriculture and adopt the mixed industries. Is there any thing difficult or unusual in this modification of pursuits? Every nation of modern Europe has made this change of pursuits. Prussia has encouraged the education and employment of her people. France, Germany, even Russia, have abandoned these effete ideas of the past for the practical progress of the present.

I cannot forbear to give an example of a change from agricultural and pastoral pursuits to manufacturing and commercial. It is given by our mother-country, England. It is exactly applicable to the situation of the Southern planting States. I quote from a tractate published in London in 1704. The thesis is: "Giving alms no charity, and employing the people in work-houses, corporations, and houses of correction a grievance to the [English] nation:"

"*Pauper ubique jacet.*" 'The poor have ye always with you,' said our famous Queen Elizabeth, when in her progress through the kingdom, she saw the vast throngs of the poor flocking to see and to bless her; and the thought put her Majesty upon a continued study how to recover her people from that poverty, and to make their labor more profitable to themselves in particular, and the nation in general.

"This was then easy to propose, for that many useful manufactures were made in foreign parts, which our people bought with English money, and imported for their use. The Queen, who knew the wealth and vast numbers of people which the said manufactures had brought to the neighboring countries, then under the King of Spain—the Dutch being not yet revolted—never left off endeavoring what she happily brought to pass, viz., the transplanting into England of those springs of riches and people. She saw the Flemings prodigiously numerous. Their cities stood thicker than her people's villages in some parts. All sorts of useful manufactures were found in their towns, and all their people were rich and busy. No beggars nor idleness, and consequently no want was to be seen among them. She saw the fountains of all this wealth and workmanship—I mean her wool—was in her own hands, and Flanders became the seat of all these manufactures, not because it was naturally and necessarily more populous than other countries, but because it lay near England, and the staple of the English wool, which was the foundation of all the wealth which was at Antwerp in the heart of that country.

"From hence it may be said of Flanders that it was not the riches and the number of people that brought the manufactures into the low countries, but it was the manufactures brought the people thither, and multitudes of people make trade, trade makes wealth, wealth builds cities, cities enrich the land, the land enriched rises in value, and the value of land enriches the government.

"Many projects were set on foot in England to erect the woolen manufactories here, and in some places it had found encouragement before the days of the Queen, especially in making cloth, but stuffs, bags, sags, serges, and such like wares were as yet wholly the work of the Flemings. At last an opportunity

was offered perfectly unlooked for, viz.: the persecution of the Protestants and introducing the Spanish Inquisition into Flanders with the tyranny of the Duke of Alva.

"As Alva ruined the poor Flemings, the Queen of England entertained them, cherished them, invited them, encouraged them. . . . This brought a vast multitude of Flemings, Walloons, and Dutch, who with their whole families settled at Norwich, Colchester, Canterbury, Exeter, and the like. From these came the Walloon Church at Canterbury and the Dutch Churches at Warwick and Colchester and Yarmouth, from these came the true born English families at these places with foreign names, such as the Devines at Warwick, the Ribons at Colchester, the Capitons, etc., at Canterbury, families to which the nation is indebted for first planting the manufactures which in time have raised the greatest trade in the world.

"This wise Queen knew that the number of inhabitants is the wealth and strength of a nation. She was far from that opinion we have of late shown too much of, in complaining that foreigners came to take the bread out of our mouths, and ill-treating, on that account, the French Protestants who fled thither for refuge in the late persecution.

"Some have said that above 50,000 of them settled here, and would have made it a grievance, though without doubt it is easy to make it appear that 500,000 more would be both useful and profitable to the nation.

"Upon the settling of these foreigners the scale of trade turned both here and in Flanders. Since the time of Queen Elizabeth this nation has gone on to be a prodigy of trade, of which the increase of our customs from 600,000 crowns to \$2,000,000 per annum, is a demonstration beyond the power of argument, and that this whole increase depends upon, and is principally occasioned, by the increase of our manufactures, is so plain that I shall not take up any time here to make it out.

"The Flemings taught our women and children to spin, the youth to weave; the men entered the loom to labor, instead of going abroad to seek their fortunes in the war. The several trades of bags at Colchester, toys and puppets at Sudburg, Ipswich, etc., stuffs at Warwick, serges at Exeter, silks at Canterbury, and the like, began to flourish. All the countries around felt the profit. The poor were set to work in trading, gained wealth, and multitudes of people flocked to the several parts where these manufactories were erected for their employment, and the growth of England, both for trade, wealth, and people since that time, as it is well-known to the Honorable House of Parliament. So that the census, as it appears to be, explains the introducing of those manufactories, and nothing else."

What an example for the planting States of the South! If Flanders grew rich and populous because of the wool of England, so have the Northern States by their vicinity to the cotton wool of the South. If manufactories increased the wealth and numbers of England, why should they not do the same for us?

We need not recapitulate the material resources of the South with which we are all familiar, but increased inducements for their combinations present themselves. The immense growth of the Union demands an enlarged scope of developement. Not only will the South furnish their home market for manufactories, but new territories are opening in our own and adjacent countries. We are much in the habit of referring to our export of cotton as an evidence of the superior productive capacity of the South, but almost the whole of the value is exchanged against commodities consumed in the production of more cotton; our better citizens of the East and West are engaged in preparing for us these commodities, so that the benefit of our earnings goes rather to them than to ourselves. It is when we compare the results of other industries with those of agriculture that we present the true causes of our sectional depression.

POLITICAL POWER OF THE SEVERAL INDUSTRIES.

The urban population may be considered as an aggregation from the capital, manufacturing and commercial interests of the country. In 1790 it was .03 per cent. of the whole population; in 1880 it had increased to 11,318,547, or 22.50 per cent. Of these, the eleven Southern planting States have a population employed otherwise than in agriculture of 1,288,110.

The whole industrial population of the Union was divided under the census of 1880 as follows:

Engaged in agriculture.....	7,470,493
Engaged in manufacturing.....	3,205,124
Engaged in trade and transportation.....	1,810,256
Engaged in professional and personal.....	4,074,238

The proportions in which these several interests are represented in the House of Representatives are as follows:

Agriculture.....	146.52
Manufacturers.....	73.26
Trade and transportation.....	36.63
Professional and personal pursuits.....	71.59

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Of these classes the twelve Southern planting States would have the following members and Representatives:

Agriculture.....	3,542,402	45 members.
Manufacturers.....	332,270	9 “
Trade and transportation.....	241,544	11 “
Professional and personal.....	818,898	20 “
		—
		85 “

We have not added the representation of the three border States which did not join the Confederacy, and which, from their vicinity to the manufacturing and commercial States of the North, are more advanced in their industries. The particular object of the paper will be to show that the planting States are deplorably deficient in the great element of popular power which has given other sections such ascendancy in the Union.

IMMIGRATION OF MECHANICS.

It is somewhat to the combined attractions of a varied industry that the other States owe their monopoly of immigrations from foreign countries, and largely of migrations from the planting States themselves of a total immigration of 518,542 in 1884. There arrived at New Orleans 1,958, 2,470 at Galveston, 7 at Charleston, 106 at Savannah, 3,590 at Key West. The professional, skilled, and miscellaneous immigrants (not laborers) numbered 241,592. As these combined every variety of employment, from a brick-maker to an artist, they naturally sought those locations where the mixed industries could afford them employment. It is to this perpetual inflow of capital and skill that is due the perfection of American manufactures, and the fact that the *United States is the largest producer of manufactures in the world!*

We cannot forbear to say that the claim of the States to an equal autonomy is delusive, since they differ so greatly in the character of political power. All sovereigns are no doubt sovereigns over their own subjects, but no mere abstract claims of right is respected beyond the ability of the sovereign to express it. Lear was every inch a king when he sheltered his dis-crowned head in a hovel. The Stuarts and Bourbons have no doubt legitimate titles under their own constructions. There were kings who gathered the crumbs under the tables of their conquerors, and one tyrant made the abject kings serve his table with their crowns upon their heads.

Instead, then, of fighting protection and manufactures it is the true duty of the South to employ her advantage of the laws and build up its industrial resources under them. To effect this object we should, (1) Employ every means to induce the importation of distant capital and skill; (2) Establish commercial, marine, and ocean carriers at the Southern ports; (3)

Educate our youth in the lecture-room and work-shop; (4) Establish a commissioner near the principal ports of immigration, to explain and impress our advantages and induce immigrants to prospect the South before settling themselves elsewhere. It will have been observed that there has been small agricultural immigration into the South. It is an individual opinion that this is in good part due to the higher prices of our good lands, to the difficulties of private title, and that the attraction elsewhere consists to a great extent in this fixity of price, the integrity of title, and the facility of acquiring small holdings. When it is remembered that we imported so much skilled labor, it is natural that those mechanics should have sought employment, and that this would have had its effect in determining the location of many other immigrants.

Those who regard the actual and impending removal of manufacturing capital from the European States to America must see that this has been occasioned by the superior economy of combining the material into products in America. The workman is now moved to the food and material instead of the expensive and unending removal of the food and material to the workmen. Will not this principle also remove the work-shops of America to the milder climate, cheaper food, more abundant material of the most eligible locations in the United States? Will not these interests descend upon Atlanta, Chattanooga, Birmingham, Louisville, Nashville, Arkansas, Tennessee, and Virginia? If England goes to New England for economical advantages, will not New England plant her mills and handicraft industries at the South?

Confiding in this logic of interest, there can be no doubt that you should begin at once to encourage the work-shop with the farm.

The preponderant immigration elsewhere is due also to the fact that the manufacturing villages and towns elsewhere afford local market for the products of the farm. An inspection of her values other than cotton or sugar produced in the various States will show that the fruits, vegetables, poultry, milk and other articles of food produced and services rendered on the farms near the towns and villages gives a higher and more attractive value to the land around, with sub-centers of population, than where the agricultural product must be sent abroad for sale.

It would then seem that this home market at which the food and material are converted into an importable product is a natural auxiliary of agriculture, and that those who are charged with the development of that most important interest are likewise concerned with the encouragement of the manufacturing interest, which can impart a value to those products of the

South which cannot bear the cost of exportation without combination, but which by reduction of bulk and increase of value may incur that expense. This will render necessary the revival of village building now.

A LOST ART IN THE SOUTH.

It may be stated as an axiom that the population of a Southern village is limited to the number of persons that may be subsisted upon the agricultural exports of the community residing around it. It is known by introducing industries that this population may have a substantial means of subsistence. Suppose we then assume any point in any railroad where fuel as a motive power, food and material may be commanded. Plant manufactories of cotton, wool, tobacco, iron. Add to them such industries as will give women employment, such as the manufacture of silk goods, making up clothing, straw goods, shoes, gloves, brooms, and other light work and hand-made goods, or made up by power sewing machines. The import of these goods to New York or Boston will enable these people to make a liberal living. It will take off the arms and hearts of the planter those who from a hinderance become an aid. It will keep at home for capitalization large amounts of cotton money now sent abroad for perishable commodities, and the South will begin to realize something from the vast values which she has annually exchanged against food, clothing, furniture, carriages, and jewelry. This cannot be done in a day, but if the planter will recognize the mechanic as his ally, when he has for so long watched him as an enemy, the immense advantages of the climate, food, and material of the planting States will be recognized and rewarded.

If the premises are correct then would our Southern, and especially the planting States, resort to the same means of acquiring numbers employed by others, and to effect this they should at once resort to the development of manufactures and commerce.

How then will it be possible that the Southern, planting States can acquire these numbers which have been known to be the controlling element of political power under our form of government?

It is an individual opinion that the construction of the Constitution has settled the power of the National Government to determine what measures are necessary for "the common defense and general welfare;" and that under this power it has been deemed necessary to protect all articles of National industry against foreign competition. It places a National system of National education upon the same authority. If the principle of protection be established by the popular will, and by formal

act and adjudications of law, there can be no dishonor in accepting and obeying these as any other law, albeit the citizen may not consider it according to the written Constitution. The moral wrong, if any, is in the legislators who enact or the judges who expound the law. To deny obedience would be to accord that there was a higher law than the Constitution as enacted and executed by the organizers of the Constitution.

In order to acquire the population essential to a full representation of the Southern and planting States, the planters, farmers, and growers should build up a home market at their own doors by organizing manufacturing villages, towns, and cities. If cotton can be condensed into cloth by a combination of the food and labor of the country, if corn can be distilled into whisky, why may not your fruits, vegetables, poultry, with the otherwise unused labor of your women and children, be embodied and consolidated into shoes, hats, baskets, and the innumerable articles which may be exported or sold at your own doors? It is a bad economy to send the pig-iron of Alabama or Tennessee to be converted into useful articles elsewhere. It is unwise, also, to send the potatoes, tomatoes, poultry, eggs elsewhere to constitute a part of the products exacted almost exclusively from cheap labor and cheap food.

THE INDUSTRIAL ALLIANCE.

You will then adopt the mechanic arts into the industrial family. You will make them the ally of the agricultural interest. You will then arrest the emigration of your youth—that fatal hemorrhage which will weaken and destroy any community. You will acquire permanent capital, and with that sustain the literature, the fine arts, the religion, cherish the amenities and the refinement of society.

You will maintain that republican representative form of government and will cherish the union which Washington founded. Coming millions may change its machinery, but the tendency with these immigrant millions will be to guard with sacred jealousy the paramount right of the people to enact, interpret, and execute their own government. These people will even bring a fresher knowledge of the abuses of Southern government. They may guard us against invasive attempts to pervert a government which despotism and chicanery could not destroy.

Remember, however, that no form of government is immortal; that your own has had premonition that it is not exempt from possible anarchy; that as it has changed, so it will change. You should, therefore, so organize your State Commissioners that the Union, like a staunch ship built in compartments, and can never be wrecked, and that in any event

you may have a complete organization, which can make you independent of all colossal or sectional dependence.

Mr. President and Gentlemen, remember that the rights of every State is the power of every State, and that this power consists in the integrity, intelligence, industry, capital, and number of your people. It is in this sense that the result of all arithmetical analysis must be that "Census is King!"

FARMERS AND THE COMMISSION MERCHANTS.

COLONEL BARTEAU'S SPEECH.

The field assigned me embraces a wider field than can be traversed in the short space of one brief address. In those sections from which our distinguished visitors come, north and north-west of us, where there is diversity of farm industry and diversity of production, we have been told there is yet to be found mortgages upon farms in great numbers. If so, I don't know under what system these came to exist; perhaps these gentlemen can tell; but speaking more directly to our own people here, I assume that the system of mortgaging for supplies to run the farm, and the relation as it is here of farmers to commission merchants, ought not to exist at all. It is the bane of this section where there is but one staple product, and of the whole cotton growing belt. Under it the lands are impoverished, the laborer kept poor and dependent, and the original owner of the land either loses it or ceases to be his own master.

There are certain principles in the very foundation of agricultural industry that in the very nature of things the farmers ought to know and stand upon. They are essential to his own, his family's and his country's prosperity.

1st. It should be recognized that the labor of the agriculturist is at the basis of all other industries and interests, individual or national.

2d. The products of his land are the sources from which the people derive the first and most important means of comfort and happiness.

3d. As the labor and the product of the farmer are the most important, so he should be the most independent.

His occupation should be honored and dignified. He has, placed by nature at his command, more capital and resources for capital than anybody. He has the land and all its fertility and the blessings to flow from it. These are entrusted to him with sacredness, and with a responsibility not to waste nor

abuse, nor, for the sake of his children, to neglect; and as this responsibility rests on him, so he should be the untrammelled proprietor and allowed full enjoyment of the fruits of his toil.

Any consent of his of giving up this proprietorship is little less than criminal, and any system of taking it away from him is wrong. Let it be custom or legislation, convenience of capital or advantage taken of his ignorance—it is wrong. To do this strikes at the very basis of distribution of wealth and happiness among the people.

Twenty years ago, to resort to the commission merchant did not mean for the farmer what it does to-day. He then knew just what charges he would have to pay, and the transaction was on the basis of a purely commission business. Now it means, first, a mortgage on the crop, the stock and farm implements, soon to be followed by one on the land itself, covering even homestead and dower and equity of redemption. It has grown into this as a system.

There were several causes at the close of the war that led the landed proprietor at first to put himself in the grasp of the commission merchant as a supply man. First, under the new system of currency he could not go to the bank and obtain money himself as formerly, either upon his personal credit or any security based on his real estate. Second, the laborers, just set free, were without means of their own, and if they staid upon the old plantation some provision must be made for them. Third, the proprietor did not divide up his land nor see any one else control his labor but himself. He then must have a fountain-head of supply, and his very natural resort was to the man who either had money of his own or could arrange for it with the banks. The commission merchant proposed to do this, being paid for advancing and receiving the benefit of commission on sale of the crop, which it was understood would be shipped to him. Simply in this way as a convenient and proper factor in commercial transactions, his money was generally safe and profits remunerative. The land-owner could get what he wanted at the lowest cash prices, as if with his own money, having made arrangements with his merchant to cash the bills upon his orders.

This became at once universal, and the first restrictive legislation that was passed by the different State Legislatures was in the interest of the landlords, the owner, to secure to him the shares or the rents from share-workers and tenants so he could meet his obligation to the merchant. But some who are dishonest or incapable, as might be expected, soon fell behind. Some who were both honest and capable could not withstand the impoverishment of land, the contingencies of drought and other causes of failure. Tighter reins must be drawn by the commis-

sion and supply men over the land owner and tenants too in order to prevent losses and make more money. He must have a mortgage upon the property, the stock and the utensils there are about the place; and then statutes were passed, not only to enable him to secure these, but also what was not yet in existence, the crop to be planted, and by contract, based on this lien, the planter bound himself to deliver to him the entire crop, no matter how much it would overpay what he owed. The work of squeezing has begun, and the once proud owner of those acres of land is now tied hand and foot, and having entered into this system of farming, and gotten behind with his merchant, is beginning to see his home slip from under him, for a mortgage upon the land has followed as the only resource at last for present support. He is no longer his own boss. The merchant, instead of allowing him to buy where he pleases at cash prices, now proposes either to buy for him or to say where he shall buy, or to furnish out of his own house the goods he wants. In either way he is compelled to take what he can get, often such as he does not want, and to see the merchant reap an advantage in the price. He has already paid for the accommodation by securing a large per cent. into the face of the amount for which he has executed a mortgage; but no difference; on every bill he makes he is charged credit, not cash prices, and interest, and sometimes commission too, although the goods were rolled out of the merchant's own house. The difference between cash and credit prices will vary from 20 to 30 and more per cent. More than this, bills are sometimes rendered monthly and amounts carried forward, interest added and thus compounded through the year. The merchant has a right to handle his crop, and here get in his work again. It is only a question of a brief time when the farmer with poor land is told that he "cannot be run any longer;" "you owe more now than your place is worth." And with the richest plantation the period is but a little extended, and thus it passes from the family and from the children who should have inherited it, and is now "run" either by the merchant with his own tenants or by some one who bought it at the sale. The toilers upon the soil, under this system, thus become as much slaves as they were under their master's lash, and the poor white farmer is under a vassalage as oppressive as the old peon system in Mexico. But is it not their own fault? They went into it; they should have staid in it.

In the cotton States millions of acres of land have thus passed away from the hands of the original owners, whose children are now poor, into the possession of the merchants, who have grown rich. It is so along the Mississippi and its rich tributaries; along the Black Warrior, and Alabama, and Tombigbee Rivers,

the finest of the cotton growing regions. Some merchants at Mobile and New Orleans owning as many as fifty plantations. One firm in Memphis is said to own thirty-six. Poor land thus cultivated becomes abandoned, and may be seen worn and washed in gulches and good for nothing. And yet, with all this, the South is recuperating; but owing more to the bounty of a beneficent Providence than the wisdom of the owners of its soil. It is quite the custom of mankind to attribute evils to erroneous causes. "Worthless labor, the indolence of the negro." This has been the cry. But we may thank our stars that the negro has been indolent, for had he been thrifty and grasping, being almost the only laborer upon the land, he could have nearly owned it all by this time. Any other race of people so situated would have done this. We may be thankful too, in another regard. If indolence is a fault, patience and cheerfulness are virtues. What other people, who are free, would work year in and year out with only decreasing hope and repeated discouragements? We fear no red handed commune among the colored people, but well might we have trembled had their places been filled by Anglo-Saxon blood. But time is the great teacher, and nothing can stay its operations. That time has come when the desire is to elevate this labor, or supplant it with other, and to see this country occupied by thrifty proprietors of the soil, no matter how small is the area of each man's home. Some few of the colored people have been very prosperous, independent with little homes dotted here and there. They have secured them by dint of hard labor and economy, not one by the aid of the commission business, and they are uniformly good citizens. All the German farmers who have come among us have succeeded by resources within themselves. We see them occasionally picking up a worn out farm, greatly depreciated in value, which they can get within a dozen or more miles of Memphis for almost nothing—at \$10 an acre and even less—and in a year or two the fences are renewed, manure is put on it, fruit trees are planted, and the improvements are made comfortable, but they do not go for aid to the merchant, nor do they raise all cotton. The place ten years ago was worth \$25 per acre, and it soon will be again.

Our best farmers have either broke away from the system of cultivating their places by means of advancements, or have been wise enough never to enter into it, and are happy in their independence. But once in, the difficulty of getting out is only known to those who have had the experience.

But few men like to plead usury any more than they do the "baby act," but few like to refuse to make an effort for another year to get even on the last; but few like to see this farming come down to unaccustomed privation; hope and pride spur on

in the same mode of working until the merchant himself tells him, "I can run you no longer; you already owe me more than your place is worth." I remember one who came to this extremity, and the day it came, said he to me, "Just six years ago, when I was comparatively easy, that merchant came out in his buggy and solicited my cotton; to-day I am a beggar." I am not urging ill-will, nor seeking to antagonize a necessarily legitimate commission business, but we want a wealth not in the hands of a few, but that which is generally distributed among the people, and is permanent because acquired by the daily practice of industry, frugality, and economy. Our farming population can effect this if they will. They have more of the elements of reproduction in the very act of consumption itself than any other class—that is, of what is called reproductive consumption. In consuming their own products, supplying their own needs—not extravagant wants, but needs—they can turn most of the waste products back to enrich the soil.

We owe it to the present colored population to increase their incentives to thrift and industry, by removing, so far as we can, all discouraging conditions of labor. The farmer owes it to his own calling to elevate its dignity and freedom from dependence. He owes it to his sons to keep them from the towns and cities, and save them from the vices that there beset them and consequent poverty; for not more than five in one hundred succeed. Keep them on the old homestead; teach them to be proud of their independent calling, to understand it well, and to be good citizens.

The Mussulman in the morning turns his face to the rising sun to pray, but his back is always to the setting sun; so it has been said that in the decline of life the world turns its back upon us more and more as we get old, and is always looking to the young and rising generation. But have not the old, in this period, and in this section, been turning their backs on the young in allowing the homes they ought to have inherited, and the soil that ought to have been left to them, to be wasted and pass away? The land is a blessing, like any other given by God. A beautiful country is left as a sacred trust to those who enjoy it, not to be abused, but improved and cultivated.

WEST TENNESSEE HORTICULTURAL SOCIETY.

This society was organized under the name of West Tennessee Fruit and Vegetable Growers' Association, at Gadsden, Crockett County, in August, 1882, which was changed in August, 1883, to West Tennessee Horticultural Society. From a membership of twelve in 1882, it has grown until it is one of the largest and most active Horticultural Associations in the South, and now numbers 150 to 200 active members.

The society is a great help to its members, enabling them to purchase package material, trees, etc., in large lots at low rates, and through its committees has obtained considerable reduction in freight rates, better facilities for transporting fruits, and general accommodations from railroad companies. A great deal of practical information is gained at the meetings about fruit growing, best varieties, profits, etc., through essays by members on subjects allotted them.

This society has been the means of placing the horticultural business of West Tennessee on a solid and profitable foundation. Men who a few years ago had nothing scarcely, and who had been raising cotton for years, trying to make money enough to enable them to buy homes, are now living in comfortable homes which have been paid for out of profits of their fruits.

More clear money has been realized out of one acre of small fruits than on ten acres of much richer land planted in cotton.

Thousands of acres of land in West Tennessee are adapted to this business and can be purchased for a trifle compared with the price of land in Ohio, Illinois, Iowa, and other Northern States.

All men are invited to visit this section of our beautiful State and learn for themselves the truth about our country. They will be kindly received and hospitably treated.

The West Tennessee Horticultural Society meets twice a year. The annual meeting on the first Thursday in February, semi-annual session on the first Thursday in August, with a called meeting or exhibition of fruits each year in May. All persons engaged in horticultural pursuits or interested in advancement of horticulture can become members on payment of fees of 50 cents semi-annually.

Officers for present year are as follows:

President, C. M. Merwin, of Medina, Gibson County.

First Vice-President, J. C. Tharpe, Gibson Station, Gibson County.

Secretary, Geo. D. Ferrell, Humboldt, Gibson County.

Assistant Secretary, Geo. T. Williams, Bell's Depot, Crockett County.

Treasurer, W. R. Rea, of Humboldt, Tenn.

The next Annual Meeting will be held at Medina, Gibson County, on first Thursday in February, 1887.

[Extracts from address of C. M. Merwin before the W. T. H. S.]

MEMBERS AND FRIENDS OF THE WEST TENNESSEE HORTICULTURAL SOCIETY: It is with pleasure that I greet you here to-day, at this the fourth annual and the ninth meeting of our society. We are here, my friends, to discuss the question of growing and marketing fruits, its profits and losses, its pleasures and disappointments, let us be careful to say nothing that will cause any one to rush headlong into the business, building air castles that will tumble down with the first light breeze of misfortune or disappointment; nor should we wish to say aught that might discourage any one from entering the field of horticulture, for there is room for many more at the top, and he who will attempt the growing of fruits and vegetables here in West Tennessee in a business-like manner, having a love for the business, may be reasonably sure of success. If he loves to care for his plants and trees, studying their habits and requirements, he has the first qualifications for a successful fruit grower.

It is the opinion of a great many that fruit-growing is overdone in West Tennessee, but I do not believe, if properly carried on that it is really overdone. It is a question like every other—with two sides to it—and one worthy of our consideration, that we who are in the business may properly understand our position. I am well aware that many persons have engaged in the business and failed to make it profitable, but this fact furnishes no proof that there is no longer any profits to be derived from the business, as failures occur in all pursuits and kinds of business. Some men will succeed best in growing cotton, others growing grain and stock, while others succeed best in the trades and professions; the great question to be solved by each one is to choose the occupation that will be most congenial and best adapted to his circumstances, and then stick to it.

That there is more fruit grown now than a few years ago, and that the supply comes nearer filling the demand, every one at all posted will admit. It is also true that the great prices which were once obtained cannot now be realized, and I believe it were better for all concerned that they never had been obtained, as exaggerated expectations were raised in the minds of many as to the profits that could be realized from fruit-growing, extraordinary heavy plantings were made, and now the prices seem too low for profit. Fruit-growing, to be successful, must be brought to a science, and as prices come down, the necessity of improvement in quality of our fruits becomes more imperative, and I would here impress the importance of greater care in the handling and marketing of our fruits.

**REPORT OF DR. J. M. SAFFORD,
STATE GEOLOGIST, TOUCHING THE WORK OF THE UNITED STATES
COAST AND GEODETIC SURVEY IN TENNESSEE.**

[* Respectfully referred to Major McWhirter for publication in report in connection with Geological Report. WM. B. BATE.]

To Gov. Wm. B. Bate:

I herewith submit a statement as to the work carried on from season to season in Tennessee by the United States Coast and Geodetic Survey.

This work was commenced in 1876, upon the application of Gov. Jas. D. Porter, made at my suggestion, and in accordance with a law of Congress, which directed the United States Coast Survey, in extending their triangulations westward, to determine points and lines in such States of the Union as had made provision for their own topographical or geological surveys, these determinations to be for the benefit of the several States, as to their surveys and otherwise. Tennessee, having a State Geologist, came under the provisions of the law. So far as giving direction to the triangulation is concerned, the work was placed under my general supervision as State Geologist. Prof. A. H. Buchanan, of Lebanon, Tenn., was recommended and was appointed by the Coast Survey authorities to do the field and office work, reporting to the officials at Washington.

As a first work, I directed him to begin with the region between Nashville and Knoxville, and as soon as practicable to connect the two cities by triangulation. The Professor went promptly to work, and in the years that have elapsed has shown himself to be eminently fitted for the service. He is an able, conscientious, and thorough worker, and has made for himself an enviable reputation at Washington. Laboring under many difficulties, he has overcome them all, and has completed the survey between Nashville and Knoxville. He has also established a base line near Lebanon, for the completeness and accuracy of which he has been highly complimented. During the last season he has been employed chiefly in the Southern part of East Tennessee, and near the line in Georgia, the object being to connect his work in Tennessee with other surveys made in Georgia. When this is completed, the triangulations will be carried from Nashville westerly to the Mississippi River. A start, indeed, has already been made in this direction.

With this triangulation running through Tennessee, it will be possible for us to have a good map of the entire State. Now, there is no basis for a map, and all existing so-called maps are

* Received too late to appear in connection with report of State Geologist.

to a considerable extent distortions, presenting our goodly surface too much awry, and almost useless for some purposes. As an example, some of the older maps make the State eight or ten miles too narrow, and the newer ones, mostly mere editions of the old, contain, as a matter of course, glaring errors.

Accurate maps are needed for manifold purposes: the proper delineation of county and land boundaries, roads of all kinds and postal routes, and for the presentation especially of geological and topographical details, and for educational uses.

Tennessee is far behind her sister States in the matter of reliable maps, and we cannot afford to treat with indifference any aid offered us toward supplying the need, especially such aid as that offered by the Coast Survey.

I may add that, in addition to the work done by Professor Buchanan, and supplementary to it, the Coast Survey has determined the latitude and longitude of a number of points in the State. Respectfully submitted,

JAMES M. SAFFORD,
State Geologist.

DECEMBER 30th, 1886.

WOOLEN MILLS OF THE STATE.

NASHVILLE, TENN., Dec. 11th, 1886.

Mr. A. J. McWhirter :

DEAR SIR—Below is a list of Tennessee Woolen Mills and locations :

Athens	Hiwassee Manuf'g Co.....	3	Sets Cards, 48.
Bolivar.	I. H. & E. M. Jones.....	1	" "
Bristol.....	M. McNulty & Bro.....	1	" "
Bristol.....	C. H. Lewis	1	" "
Bristol.....	Rutherford Woolen Mills..	1	" "
Chattanooga	Joseph Ruohs.....	1	" "
Cleveland.....	Cleveland Woolen Mills.....	3	" " 48.
Columbia.....	Marcella Falls Woolen Mill..	1	" " 48.
Cornersville	Robert Eastwood	1	" "
Dowelltown	Allen Wright.....	1	" "
Elizabethton	Watauga Woolen Mills.....	2	" "
Gallatin	Eagle Woolen Mills.....	1	" "
Garber's Mills	Henry Miller & Son.....	1	" "
Greeneville.....	B. T. Stevens & Bro.....	1	" "
Home	Home Woolen Co.....	1	" "
Hurricane Mills...	G. W Hillman.....	1	" "
Jackson	Jackson Woolen Mfg. Co...	3	" " 48.
Knoxville	Knoxville Woolen Mills	4	Sets Cards, 60.
Maryville.....	Hanna & Thorne.....	1	" "
Maryville.....	W. T. Parham.....	2	" "
McMinnville.....	Clay Faulkner.....	1	" "
McMinnville	Cantrell & Faulkner	3	" "
Nashville	Nashville Woolen Mill Co..	4	" " 60.
Peacher's Mills ...	H. O. Hambaugh & Co	1	" "
Persia	W. A. Kirkpatrick.....	1	" "
Post Oak Springs.	Owings & Wattenbarger.....	1	" "
Tullahoma	Tullahoma Woolen Mills....	4	" "

Yours Truly,

LEONARD PARKES.

LIST OF COTTON MILLS IN TENNESSEE.

NAME.	SPINDLES.	LOOMS	LOCATION.	POWER.
Brient Bros-----	528	-----	Athens-----	Water.
Mt. Verd Mills Co-----	1,600	-----	Athens-----	Water.
W. A. Sparger-----	1,000	18	Bristol-----	Water.
Chattanooga Cotton Factory-----	1,024	-----	Chattanooga.	Steam.
Columbia Mills Co-----	6,500	174	Columbia-----	Steam.
Ruohs, Joseph (not running)-----	2,000	13	Chattanooga.	Steam.
Gallatin Cotton Factory (not running)-----	4,864	136	Gallatin-----	Steam.
Spring Creek Mills-----	600	16	Henry-----	-----
Brookside Cotton Mills-----	6,000	200	Knoxville-----	-----
Cranson Mill-----	576	-----	Lawrenceb'g	Water.
Eagle Mills-----	1,146	-----	Lawrenceb'g	Water.
Shoal Mills-----	1,056	36	Lawrenceb'g	Water.
Lenoir Mfg. Co-----	984	-----	Lenoirs-----	Water.
Falls Mills Mfg. Co. (not running)-----	1,036	9	Maxwell-----	Water.
Annis Cotton Mill-----	2,160	60	McMinnville.	Water.
Pioneer Mill-----	5,272	132	Memphis-----	Steam.
Nashville Cotton Mills-----	9,000	132	Nashville-----	Steam.
National Mfg. Co-----	5,300	-----	Nashville-----	Steam.
Tennessee Mfg. Co-----	26,000	772	Nashville-----	Steam.
Henry Warren's Sons-----	864	16	Oregon-----	Water.
J. T. Currier & Co-----	1,113	-----	Paris-----	Water.
Paris Mfg. Co-----	1,200	-----	Paris-----	-----
S. L. Graham & Son-----	2,288	44	Pinewood-----	Steam.
Vale Mills-----	1,000	-----	Pulaski-----	Water.
A. J. Patterson-----	940	12	Union Depot	Water.
Rockford Mfg. Co-----	2,630	-----	Rockford-----	Water.
Trenton Mfg. Co-----	3,200	100	Trenton-----	Steam.
Sylvan Mills-----	3,600	104	Shelbyville--	Steam.
Totals-----	93,481	1,974		

LIST OF IRON FURNACES.

THEIR LOCATION—NAMES OF OFFICERS—NUMBER HANDS
EMPLOYED—OUTPUT PER WEEK, ETC.

ÆTNA IRON COMPANY.

Location—Ætna, Hickman County, Tenn.

Officers—Jas. C. Warner, President; Leslie Warner, Secretary and Treasurer; Percy Warner, Vice-President and General Manager.

Size of Furnace—11 x 55 feet.

Size of Engine—25 x 60, 4-foot stroke.

Character of Ore—Brown hematite.

Character of Fuel—Charcoal.

Number of Hands—About 500.

Output per Week—300 tons.

Character of Iron—Car-wheel and foundry.

Number of Kilns—20.

Acres of Land—32,000.

CHATTANOOGA IRON COMPANY.

Location—Chattanooga, Tenn.

Officers—Joseph E. Brown, President; W. C. Morrill, Vice-President and Secretary; L. S. Colyar, Manager and Treasurer.

Character—Hot blast, coke for fuel.

Number Acres—Seven (7).

Bosh—13 feet.

Height of Stack—65 feet; one stack only.

Engine—One Weimer Blowing engine, with 42-inch steam cylinder and 48-inch stroke and blowing cylinder 7 feet in diameter; 1 Webster engine, 30-inch steam cylinder and 6-foot blowing cylinder.

Ores—Red fossil ores from Tennessee River above Chattanooga and from Stations on the Alabama Great Southern Railway west; also brown ores obtained near Cartersville, Ga., on the Western and Atlantic Railroad. Location of the ores ranges from 25 to 100 miles from Chattanooga.

Hands—75 employed at furnace.

Product—Chiefly foundry grades of pig-iron, and sell from Maine to Minnesota, and to the Southern States. Furnace located on the Tennessee River bank, and has rail connection with all railroads centering in Chattanooga.

Output—400 tons weekly.

CITICO FURNACE COMPANY.

Location—Chattanooga, Tenn.

Character—Hot blast.

Output—About 560 tons pig per week.

No report received from the manager.

TENNESSEE COAL, IRON & RAILROAD COMPANY.

Tracy City Division—Tracy City Post-office, Grundy County, Tenn., twenty miles from Cowan, on the Nashville, Chattanooga & St. Louis Railway, and connected with same by the main track, comprises: coal mines, 8 openings from daylight; 20 miles of iron track under ground, 800 coal buggies, 100 mules, 2 pump engines and boiler, 3 engines and boiler for conveying coal and coke to the ovens, 8 coal crushers, 4 chutes and tipples, 580 coke ovens, 2 saw-mills. Buildings: 1 three-story brick office and store, 1 stone round-house and engine shops fully equipped, 3 depot buildings, 1 stockade for 500 convicts, 200 tenement houses. Land: 25,202 acres.

Cowan Division—Cowan, Tenn., on the main line of the Nashville, Chattanooga & St. Louis Railroad, in Franklin County, Tenn., comprises: 1 blast furnace 15x65 feet, with draught stack 167 feet high; 2 Weimer engines, steam cylinders 36x48 inches, blowing cylinders 48x72 inches; 3 Whitwell hot blast stoves, 12 tubular boilers, 1 stack house 200x100 feet, 1 brick engine house with iron roof, 1 brick cast house with iron roof, 1 steam Otis elevator, 1 mile of iron track, 1 two-story frame store house, 1 one-story office, 1 smith shop, 1 stable, 71 tenement houses, 94 acres of land.

South Pittsburg Division—Central office at South Pittsburg, Marion County, Tenn., on the Jasper Branch of the Nashville, Chattanooga & St. Louis Railroad, and comprises: 2 blast furnaces (No. 1, 70 feet high, 16 feet diameter on top, 20 feet bosh, and 9 foot hearth; No. 2, 70 feet high, 14 feet diameter on top, 20 feet bosh, and 10 foot hearth); 7 Whitwell hot blast stoves (4 22x30 feet, 3 18x60 feet), 36 double boilers, 4 blast engines (2 English "Stevenson," 2 "McIntosh & Hemphill"), 2 loco-

tives (1 30 ton engine, 1 12 ton engine), 60 iron slag cars, 2 Berryman heaters, 3 Cameron pumps, 2 Worthington pumps, 2 Crane elevators, 1 Blake crusher, 1 iron cast house 114x112 feet, 1 stack house covered with iron, 48x375 feet; 1 engine house with cast-iron tank, 48x28x6 feet; full equipment of coke and ore buggies with all necessary tools and implements; water supply duplicated by 8-inch main from mountain reservoir one-half mile long with 400 feet head, and by 10-inch main from pumping well, connected by tunnel with Tennessee River; machine shops 60x120 feet, completed with all the latest patterns of improved machinery. The foundry, 60x120 feet, has two cupolas with a capacity of 10 tons per day, supplied by a large Blake's Rotary Blower, and is thoroughly equipped with moulding machines, derrick, core oven, portable forges, etc. Near this building are the brass foundry, pattern shops and offices. The car shop, 60x60 feet, with machine shop and foundry, form one large building. The company has built many cars for itself, the Alabama Great Southern Railroad and others. A steam saw mill capable of turning out 7,000 feet of sawed lumber daily is on the banks of Battle Creek, about one-quarter of a mile from the furnace. A limestone quarry showing a face of 600 feet long and 30 feet high affords an inexhaustible supply of limestone. A lime kiln is also in operation. The colliery at this place, called Battle Creek Colliery, supplies an excellent quality of household coal. It is owned by the company, but operated by others who pay a royalty upon all coal mined. Railroad tracking, 2 1-10 miles.

At Victoria, 14 miles north of South Pittsburg, are located 110 coke ovens. The coal deposits tributary to these ovens admit of driving mines for several miles without any break, and these deposits will be opened up by the projected railroad extension previously named. At this point the company also owns a brick store and offices and about 40 tenement houses.

At Inman, five miles beyond Victoria, are situated the company's Ore Mines, consisting of about 6,500 acres of ore land underlaid with continuous vein of red fossiliferous ore averaging five feet six inches in thickness. This ore is made both by stripping and drifting, and of it the company is now using about 500 tons daily. The plant here consist of about two miles of iron track, and one Rand air drill plant complete, with engine, compressor, boilers, and twelve drills. The company own here about forty tenement houses, with office and store, and also a large stockade for accomodating 200 convicts.

At Buzzard Raost, in Cocke County, Tenn., the company owns large tracts of excellent ore lands heavily timbered, and valuable deposits of barytes, manganese, and granite. The land comprised in this (South Pittsburg) division is 98,000 acres.

The Real Estate owned by the company is approximately as follows: 200 acres suitable for works and town at South Pittsburg; 2,000 acres of coal and lumber land at South Pittsburg; 32,000 acres of land on Cumberland Mountain in Marion, Sequatchie, and Bledsoe Counties; 6,500 acres of ore land on Walden Ridge in Marion County; 56,000 acres of land in Cocke and Greene Counties; 25,200 acres of ore land in Grundy County; 94 acres of town land in Franklin County; 121,994 acres in all.

Output—Cowen, 500 tons pig per week; South Pittsburg, 1,200 tons pig per week (2 stacks); about 1,840 hands employed.

The company is now building 200 coke ovens at Whitwell, and with those already built, 100 coke ovens at Victoria, will be supplied with coal from the Whitwell Mines for coking purposes. The company has given out contract for building another furnace 17 feet bosh and 75 feet high—capacity, 600 tons weekly—which will be completed and in operation at South Pittsburg before January, 1888. They are now opening an extensive coal mine at Whitwell—having 60 men employed constantly night and day—capacity when in operation of 1,000 tons per day. The lands upon which this mine is located have been purchased by the company within the last few days, embracing 2,000 acres.

Officers—Enoch Easley, President; address, Pratt Mines, Ala. T. T. Hillman, Vice-president; address, Birmingham, Ala. Nat. Baxter, Jr., Chairman Executive Committee; address, Nashville, Tenn. A. M. Shook, General Manager; address, Tracy City, Tenn. J. Bowron, Treasurer; address, Nashville, Tenn. C. Flisher, Secretary; address, Nashville, Tenn.

WARNER IRON COMPANY.

Officers—Jas. C. Warner, President; Leslie Warner, Secretary and Treasurer; Percy Warner, Vice-President and General Manager.

Size—Furnace 11 x 55; Blowing engines 32 x 72 in. 4-foot stroke.

Character of Ore—Brown hematite.

Character of Fuel—Charcoal.

Number of Hands Employed—About 500.

Output per Week—300 tons.

Character of Iron—Car-wheel and foundry.

Number of Kilns—16.

Acres of Land—16,000.

The boiler-plate for *Ætna* Furnace boilers were made from pig-iron made at the Warner Furnace.

LA GRANGE FURNACE COMPANY.

Stewart or Stribling Post-office, 7 miles west of the main line of the Memphis & Clarksville branch of the Louisville & Nashville Railroad, Stewart County, Tenn.

Capitalized; bonds \$300,000, and stock \$500,000.

Directors—G. M. Fogg, Jno. P. White, Archer Brown, James C. Warner, T. W. Wrenne, Jno. P. Williams, H. W. Grantland.

Officers—Jas. C. Warner, President; Archer Brown, Vice-President; Leslie Warner, Secretary and Treasurer.

Product—Car-wheel pig.

Output—About 45 tons per day.

SHOAL CREEK IRON COMPANY.

Saint Jo, Lawrence County, Tenn.

Capitalized at \$150,000.

Property consists of 3,000 acres ore land, bearing a brown hematite iron ore, which assays from 52 to 57 per cent. pure iron.

This company is prepared to deliver 400 tons washed ore daily.

Thomas Sharp, President; Julius Sax, Secretary; and Ed. Baxter Chairman Executive Committee.

The Nashville & Florence Branch of the Louisville & Nashville Railroad is completed to these ore banks, and will be pushed through to Florence, Ala., in the very near future.

DAYTON COAL AND IRON COMPANY, LIMITED.

DAYTON, TENN. Nov. 30th, 1886.

A. J. McWhirter, Esq., Commissioner, Nashville, Tenn.:

DEAR SIR—Yours to hand, in reply would say: Location and name of furnaces, Dayton, Tenn.; hot blast, 2 stacks 75 feet high by 20 feet bosh, with six Whitwell's stoves. One in blast now, and one being relined to 18 feet bosh, expected to go in blast March 1st, 1887. Five vertical engines about 500 horse-power each; acres of land owned about 100,000; ores used: Red fossiliferous from up the Tennessee River 20 to 40 miles; brown hematite from Georgia; Rockwood ore from near Rockwood, about thirty miles north on the C. S. Ry.; Limestone from own quarry, about one-half mile from furnaces. Production, about 100 tons pig-iron per day. Market, Cincinnati and North. Transportation facilities, C. S. Ry., and Tennessee River, which

is three miles away. Men employed, about 600, of which 100 are employed at furnace.

Names and post-office addresses of officers: W. J. Isaacson, Managing Director, 10 Johnston Building, Cincinnati, O.; George Jamme, General Manager, Dayton, Tenn.; James Duane, Furnace Manager, Dayton, Tenn.; P. Johnson, Cashier and Book-keeper, Dayton, Tenn.; Rees Gwillim, Supt. Richland Mines, Dayton, Tenn.; J. B. Carter, Supt. Nelson Mines, Dayton, Tenn.; I. F. Overholt, Supt. Coke Ovens, Dayton, Tenn.; A. W. Schenck, Mining Engineer, Dayton, Tenn.; H. S. Fleming, Chemist, Dayton, Tenn.; James Connelly, Yardmaster, Dayton, Tenn.; G. A. Guenther, Storekeeper, Dayton, Tenn.

Yours Truly,

THE DAYTON COAL & IRON Co., Limited.

Per P. JOHNSON.

DROUILLARD IRON COMPANY.

CUMBERLAND FURNACE, TENN., November 30th, 1886.

Mr. A. J. McWhirter:

DEAR SIR—Yours of the 26th to hand and noted. Will say in reply: Number of acres, 18,000; size of bosh, $9\frac{1}{2}$ feet; height of stack, 35 feet—one stack; relief valve engine, 20 inches and $4\frac{1}{2}$ feet stroke; brown hematite ore, charcoal, blue and gray limestone; number of hands employed at furnace, 22; in banks, 60; in coalings, 150; output per week, 120 tons; character of pig, Nos. 1 and 2, foundry and mill; sold in St. Louis, Louisville, and Cincinnati; transportation, river.

Yours truly,

DROUILLARD IRON COMPANY,

Per R. B. STONE.

ROANE IRON COMPANY.

Rockwood, TENN., Nov. 30, 1886.

A. J. McWhirter, Esq., Commissioner, Nashville, Tenn:

DEAR SIR—Replying to yours of the 24th:

1. Name of works, Rockwood Furnace, Roane Iron Company.
2. Rockwood, Tenn.
3. H. S. Chamberlain, President, Chattanooga, Tenn.; M. M. Duncan, Superintendent, Rockwood, Tenn.
4. Twenty thousand acres.
5. Two stacks 65 feet high; 13 and 15 feet bosh; hot blast.

6. Four engines; 1 steam cylinder, 38-inch diameter; blowing cylinder, 84 inch; stroke, $4\frac{1}{2}$ feet; 1 steam cylinder, 36 inch; B. C., 84 inch, 4 feet stroke; 1 steam cylinder, 36 inch; B. C., 72 inch, stroke, 4 feet; 1 steam cylinder, 31 inch; B. C., 72 inch, stroke, 4 feet.

7. Red fossil, from company's mines and Tennessee River; first, 1 mile from furnace; second, 14 miles.

8. Limestone, subcarboniferous $1\frac{1}{2}$ miles from furnace.

9. Coal $\frac{1}{2}$ mile from furnace.

10. Number of hands at furnaces, 75.

11. Ore banks are contracted.

12. Hands in coal bank, 200.

13. Two hundred and fifty men.

14. Eight hundred tons output.

15. Foundry iron.

16. West and Northwest.

17. Cincinnati Southern Railroad.

18. One hundred and eighty bee-hive coke ovens.

Yours truly,

MURRAY MORRIS DUNCAN,
Superintendent.

57 Com Ag

TENNESSEE CREAMERIES.

Maj. A. J. McWhirter, Commissioner of Agriculture:

DEAR SIR—As per your request I herewith furnish you with an account of the creamery enterprise in this State—its present condition, etc. There are four creameries in active operation in this immediate section of the State. The Tennessee Creamery, at Nashville, the Lebanon Creamery, Lebanon, Tenn., the Bellbuckle Creamery, Bellbuckle, the Stone's River Creamery, at Murfreesboro. The amount of capital invested in buildings and machinery in these four will aggregate \$20,000. They are supplied with all the modern and improved machinery for making butter and cheese, with the exception of the Tennessee Creamery, at Nashville, which has no machinery for making cheese, and does not attempt it.

There are some 125 farmers engaged in supplying these four creameries with milk; between 800 and 900 cows supply the milk. From forty to fifty men find employment in milking, and delivering the milk to these several factories. 3,500 to 4,000 dollars per month is paid out to the several farmers sending milk to the creameries, where from 10,000 to 12,000 pounds of milk is handled daily. They could, with very little additional expense, handle 40,000 pounds daily, as they have an unlimited market for all the butter and cheese that can be produced. A feeling of confidence in the business has sprung up among the farmers, and they are now not afraid to invest their money in cows to supply milk to the creamery, and we look for a large increase in the receipt of milk for the next six months.

This industry is an acknowledged success in this State, and the farmers who have the advantage of a creamery in their neighborhood have a permanent market for all the milk they can produce, at prices that make dairying the most profitable branch of farming practiced in this State. There are many advantages in dairy farming. Every farmer in the State could keep from ten to fifteen cows with a creamery for his market.

A recent organization in Rutherford County deserves special mention in this report, which shows a step in the right direction, and should be followed by the patrons of other creameries.

THE RUTHERFORD COUNTY DAIRY ASSOCIATION.

The patrons of the Stone's River Creamery recently organized themselves into an association, to be known as the Rutherford County Dairy Association. Mr. J. M. Naylor was elected President and Mr. R. G. Young Secretary. Some thirty names were

enrolled as members. The object of this association is to encourage the dairy business in Rutherford County and to discuss topics pertaining to their business. They meet the first Saturday in every month. A full discussion is had at these meetings of what each member has done, how many cows he milks, and how much money he makes. Thus, by their practical experience they teach themselves the most economical methods of producing milk. (This association has nothing to do with the management of the creamery—that is owned by other parties.) If an association could be formed in every county of this kind to encourage the dairy business, and to build a creamery. Great good would come to the State. The value of our dairy products would be doubled if the milk produced in the State could be worked by creameries.

CHEESE MAKING.

Cheese making has proved a success. Some of the most intelligent men in the State thought, a few years ago, that cheese making could never be made a success in this State. The Stone's River Creamery, at Murfreesboro, has made this a special feature and have been eminently successful. They turn out a cheese that commands the full market price, and the merchants who handle it are well pleased. A word must be said in praise of the wholesale merchants in Nashville, who have given every encouragement to the effort that has been made to produce a cheese suitable for this market. The Stone's River Creamery has never abandoned the making of cheese. They have stuck to it amid all the discouragement of careless handling of milk by farmers. The milk must be brought to the factory in good condition to make cheese, and it has been a hard fight to get the farmers to appreciate the importance of this.

BUILDING.

The building required for a creamery and cheese factory, is a two-story building, forty by fifty feet.

MACHINERY.

One of the principal and most important machines needed in a modern creamery, is the cream separator. This wonderful machine is of Danish invention, and has revolutionized butter making in the States; and to this invention the Southern people will be indebted for the developement of our dairy resources. A brief mention of what this machine will do, will give you some idea of its value and importance. With this machine we extract the cream from the milk fresh from the cow. It is done on the principle of centrifugal force. The profitable point in making butter is to get all the cream from the milk. This separator absolutely gets it all. The skim milk is the most veritable blue-john you

ever saw. The advantage over the old system, and the point that affects our part of the country is this: We are enabled by the use of this machine to take the cream from the milk a few hours after it has been taken from the cow, and consequently the cream is ready for the churn some twelve hours from the time it is milked; whereas with the old plan of setting the milk for the cream to rise, it will take some twenty-four to thirty-six hours to raise it, and another twelve hours for it to ripen sufficiently to churn. In our climate, where we have from eight to nine months of summer, it is a difficult matter to find a farmer who is the fortunate owner of a spring whose temperature is sufficient to raise the cream in twelve hours. If the milk should become acid during this process, the process of raising the cream is suspended at once, consequently the cream left in the milk is a total loss. This is the reason such a yield of butter is obtained from milk by farmers generally. At least ten per cent. more cream is obtained by the use of the separator, and you have your butter on the market from twenty-four to thirty-six hours sooner. This is a great advantage when you know the perishable character of milk. Again, very few of our farmers could engage in the dairy business, as numbers of them have no springs on their farms—with the advent of this wonderful machine, it is practical for every farmer to be a successful dairyman.

The advantage of cheese making which this machine makes practicable, is this: The milk after the cream has been taken from it, is left sweet and in prime condition for cheese making, but it has been robbed of the cream which makes the quality of the cheese. Skim milk cheese has been almost entirely abandoned, as it is unfit for food, consequently fresh milk from the cow is added to the skim milk, in proportion to the richness of which you desire to make your cheese. This was the mistake our Tennessee creameries made. In starting they made cheese from the skim milk alone, it became so hard and dry it could hardly be cut with a knife. They now add sufficient fresh milk to the skimmed milk to give it about one-fourth of its original richness in quantity or weight, which makes a cheese that is palatable and suitable for our Southern market.

The balance of the creamery outfit consists of cheese vats, churns, cheese presses, engine and boilers, and other apparatus that would weary your readers to mention. The total cost of building, land, and complete outfit for making cheese and butter—put up and in running order—will be from \$4,000 to \$5,000. It will take the milk of about 200 cows to pay expenses. The same expense will handle the milk of 500 cows. With 200 cows a creamery can pay the market price of milk, which is based upon the highest market price of butter, and its running expenses.

The milk of 500 cows will make a handsome profit to the owners of the creamery.

The probable value of the milk of one cow for a year will greatly depend upon the quantity she gives. Farmers can calculate on obtaining about \$1.05 per 100 pounds of milk, based upon the selling price of butter. A cow that will not give 4,000 pounds of milk during the year deserves to be sent to the butcher. With care and judgment in selecting a herd of cows, and with proper care of them, you should make them yield at least from 5,000 to 6,000 pounds each per year. This would give the farmer, say, from \$55 to \$65 income from each cow, besides the valuable amount of manure he has received from her, with which he is enabled to keep up the fertility of his soil. To keep a cow economically it will cost about \$36 a year. This, at the market price for the feed you give her, gives you a net profit of from \$19 to \$29 per year on each cow. Cows have been known to give as high as 18,000 pounds of milk in a year. The more milk you get the more profitable the cow. Again, our farmers have suffered greatly for want of a quick money crop. Our system of agriculture, as generally practiced, give us money only twice a year; that is, wheat in June and cotton in the fall. Now, with the dairy business, with the creamery for a market, the farmer draws his money monthly. This comes as regular as his cows are milked. It is said that in the dairy districts of the West a man's income is reckoned by the number of cows he milks. Tennessee is the natural home of the dairy cow. I speak principally of Middle Tennessee. We have produced two of the greatest butter cows in the world. Our climate, and almost perpetual green pastures, give our country an immense advantage over our Western brethren, whose dairying is practically limited to eight months in the year. We can make milk cheaper in Middle Tennessee than any country in the world, if our farmers will go about it in the right way. Wealth and prosperity are within the grasp of our agricultural people if they will take hold and introduce the creamery to make their milk into butter and cheese.

Yours truly,

ROBIN JONES,
Nashville, Tenn.

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ERRATA.

Page 3, for Parmers read Farmer's.

Page 5, for 100-ton read 45-ton.

Page 6, sixth line from top of page, after lands, read in Clay and Overton co.

Page 17, for excel read exceed.

Page 22, for strata read stratum.

Page 31, for twenty-two read twenty-one.

Page 35, for has been, read was.

Page 38, for Christiana read Cyntfiana.

Page 40, for F. B. Swipes read F. B. Snipes.

Page 40, for Tennessee Live-stock Commission read Tennessee Live-stock Survey
Commission.

Page 42, for N. H. Pearson read N. H. Paaren.

Page 42, for F. B. Swipes read F. B. Snipes.

[illegible]

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